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The Manufacture of Laminated Safety Glass

A Review of the United States Patents Relating to the Manufacture of Transparent, Reinforced, Non-scatterable Glass

By Joseph Rossman[1]

AMONG the new industries that have come to the front in the past few years one of the most interesting ones is the laminated glass industry. From a seemingly unimportant war-time invention, the growth of the automobile industry has made it one of the most important developments that has occurred in glass in many years. Two years ago, when production of laminated glass was started in this country, only one in every two hundred thousand cars was equipped with safety glass. Now one automobile in every twenty has such glass in it. More than twenty million dollars has been put into the production and marketing of non-shatterable glass, during 1928. This figure includes outlays by manufacturers, distributors, retail glaziers and direct retail branches of manufacturers. Among the most prominent producers of this new glass are the Pittsburgh Plate Glass Company (Pittsburgh Safety Glass Company), the Triplex Safety Glass Company of North America, and the Libbey-Owens Sheet Glass Company. The Safetee Glass Company and the Indestructo Glass Corporation also produce safety glass, and in Canada a laminated glass factory is under construction. Others are building plants or increasing existing facilities to meet the growing demand.

This article treats (in installments) of the technical processes involved and sets forth the various difficulties that are being encountered in the various methods of production.

THE glass industry has recently shown a great interest in non-scatterable glass, made by the use of plastic reinforcing material. Nearly all the patents for this type of glass have been granted during the last ten years. Many inventors are still at work attemping to evolve new and practical methods for producing this safety glass.

The earliest attempts to produce safety glass by means of a plastic material consisted in securing a sheet of celluloid between layers of glass. This laminated glass has great practical value and has found extensive use in goggles, aeroplane windshields, automobile windshields, closed automobile windows, bullet-proof partitions in banks and signal lights. The sheets of glass adhere so tightly to the celluloid that if the glass is struck a blow it will not scatter although it may be splintered into many pieces.

Although the structure of safety glass is very simple, many difficulties have arisen in its manufacture. Many of the cements used are subject to the following defects which have been outlined in a recent patent.

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(a) The laminæ when ready for assembling are slippery and therefore handling of the product presents numerous difficulties, resulting in the production of large proportions of imperfect product.

(b) Lack of sufficient bonding strength or adhesion to render the finished article valuable for its non-shatterable qualities.

(c) Lack of complete "fluid" transparency, thereby rendering the planes of surface contact more or less visible.

(d) Presence of the effect of milky strata or cloudiness between the laminæ.

(e) Excessive action upon the celluloid layer, which causes flabbiness, weakness and great liability to form bubbles upon the application of slightly elevated temperatures.

(f) The presence of solvents of so volatile a nature that permanency is either impossible or dependent altogether upon protection from volatilization and consequent disintegration by an impervious seal at the edges.

(g) Presence of solvents so active that the celluloid surfaces immediately swell and become very slippery and so render the articles weak and very difficult to handle successfully.

(h) The plastic binding material may develop objectionable coloration.

The First Patent for Reinforced Glass

One of the first patents for reinforced glass is the French patent No. 321,651 granted in 1902. The object of the invention was to provide a layer of celluloid on glass containers or tubes which are likely to be broken and lose their contents. The process is carried out by dipping the vessel in an acetone solution of celluloid, the concentration of the solution being varied in proportion to the desired thickness of the celluloid layer. After the immersion, the vessel is dried so as to evaporate the solvent. This process may be repeated until the desired thickness of celluloid is obtained. If the glass vessel should be broken it will not lose its contents since the celluloid will hold the pieces together.

The First U. S. Patent

The first U. S. patent No. 830,398 was granted to John Wood, an Englishman, on Sept. 4, 1906. This patent discloses a process of making safety glass similar to that used to-day. He states that his invention relates to improvements in transparent screens and windows for motor cars and other vehicles, and has for its object the prevention of injury to the occupants of such cars and vehicles through pieces of glass striking them if by accident such screens or windows should be broken, the pieces of broken glass adhering to the screen and not becoming detached. It also has the advantage over celluloid screens or windows in avoiding the danger of catching fire. Celluloid screens, soon become scratched and rendered less transparent. Celluloid screens are not rigid and are apt to warp and thereby distort the vision.

The invention consists in providing two sheets of glass between which is fixed or cemented a sheet or film of any transparent adhesive substance or material with sufficient elasticity to prevent splintering when broken and provide an agglutination or hanging together of the parts. For example a sheet of celluloid is used between two sheets of glass or a film of a substance such as gelatin or other transparent substance less brittle than glass and not liable to splinter.

In carrying the invention into effect, two sheets of glass are fixed by mean of a suitable cement, such as "Canada Balsam," to a central sheet of transparent celluloid or other similar material having the requisite strength and transparency and sufficiently adhesive—i. e., capable of being made to adhere to the exterior sheets of glass. In this way a transparent combination of material or "sandwich" of sufficient rigidity is provided in which the exterior layers of glass provide a hard non-inflammable surface, readily cleaned and not liable to lose its transparency by scratching or loss of polish and in which the inner layer firmly adheres to and supports the exterior layers, so as to reduce their liability to become cracked and prevent portions from breaking away or splintering even should cracking occur.

Description of the Process

Referring to Figs. 1 and 2, a and b designate the two exterior sheets of glass, and c denotes the interior sheet of celluloid. These exterior glass sheets a and b are cemented by a layer of Canada balsam in sandwich form on either side of the interior sheet of celluloid. The letter d designates a tray or bath of about one inch or suitable depth, which is partly filled with liquid Canada balsam. This tray d is adapted to fit and rest on a shallow tank e, which is filled with hot water for the purpose of heating and thereby reducing the consistency or density of the Canada balsam in the tray d and making it thinner as a liquid. A sheet of plate glass b, previously warmed is placed in the tray d, submerged in the Canada balsam. A rather large sheet of transparent clear celluloid c is then placed in tray d over the glass sheet b, submerged in the Canada balsam, taking care that no air remains between the glass sheet b and the celluloid sheet c. Another sheet of plate glass previously warmed is placed with its edge on the celluloid sheet c so that it rests over the corresponding edge of the first sheet of glass b. The second sheet of glass a is gradually lowered into the tray d and submerged in the Canada balsam, so that no air remains between it and

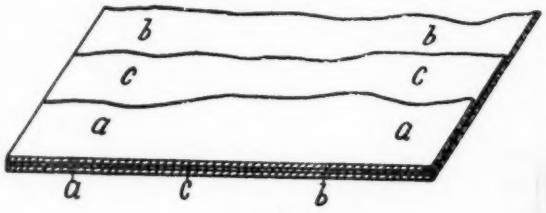


FIG. 1

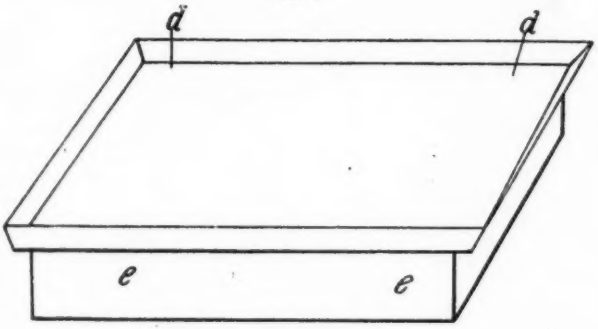


FIG. 2

the celluloid sheet c. The two sheets of glass, a and b, with the celluloid sheet c are then slightly pressed together in the tray d. The combined sheets of glass and celluloid a, b and c are then taken out of the tray d and the edge of the celluloid is cut off close to the glass.

Acetone As a Celluloid Solvent

Edouard Benedictus of Paris obtained several U. S. patents for reinforced glass. His first patent 1,098,342 May 26, 1914, unites two sheets of glass together by means of a sheet of celluloid coated with acetone. Instead of transparent celluloid, colored or ornamented celluloid may be interposed between sheets of glass which themselves may be transparent or ornamented. Although the use of celluloid appears preferable by reason of its solidity it may be replaced by sheets of viscose, casein or other translucent and strong material which will enable the sheets of glass to be stuck together. The sizes of the sheets of glass and of celluloid may be of any desired proportions. The celluloid may be extremely thin. It may be applied, if desired, in the pasty form, by coating one of the sheets of glass with a layer of celluloid in solution and by compressing the other sheet of glass upon it. The sheets of glass to be assembled together need not be strictly flat; the want of planity of window glass so far from being an inconvenience actually become a condition very favorable to the resistant strength of the product, if care be taken to assemble the sheets, the convexity of one sheet being turned toward the convexity of the other sheet.

The Use of Vacuum

The method of the Benedictus U. S. patent No. 1,128,094 Feb. 9, 1915 consists in making reinforced glass by

softening the surface of a sheet of celluloid by means of a volatile solvent, sandwiching the sheet between sheets of glass, subjecting the juxtaposed sheets to a vacuum to remove excess solvent, and then subjecting the sheets to atmospheric pressure while the surface of the binding material is still pasty under the influence of the solvent, whereby the sheets are firmly pressed together.

In a receiver filled with volatile solvent such as acetone or amyl acetate the sheets of glass and the sheet of celluloid are dipped in succession in such a way that they are superposed in the proper order. After an immersion for some seconds they are removed together and allowed to drain or drip and placed in a closed chamber where a vacuum is formed by any suitable means. After the excess solvent and confined air, if any, have been expelled and while the faces of the celluloid are still pasty from the action of the solvent, air is again admitted to the receiver and the atmospheric pressure exerted against the exposed faces of the sheets, presses them together firmly and insures a perfect joint. It is not necessary to carry the rarefaction to an absolute vacuum; experiments show that a vacuum of 15 millimeters of mercury may be sufficient. The higher the vacuum is carried the more rapid is the operation. It may be further accelerated by the action of heat. It is preferred to act suddenly by the vacuum. The vapors of the solvent which have been liberated under the action of the vacuum may be drawn off into a reservoir wherein they are recovered by condensation.

Gelatin As a Reinforcing Layer

In his next U. S. patent 1,182,739, May 9, 1916 Benedictus discloses a process which relates to the use of gelatin as a reinforcing layer. Gelatin liquefies at comparatively low temperature and has the advantage of being readily attachable to glass or celluloid under the action of moderate heat without the use of a solvent to soften the surfaces which are to be united. The present invention subjects the gelatin at the moment of sticking to a liquid such as 95% ethyl alcohol, which is both hygroscopic and volatile. The alcohol dehydrates the gelatin. Moreover the gelatin is neither dissolved and attacked, so that the alcohol can be readily expelled by heat.

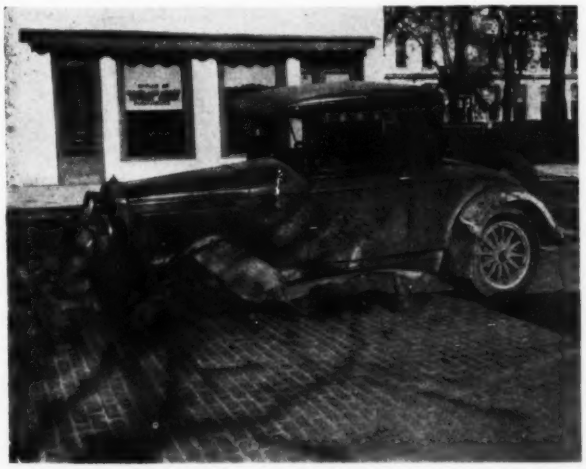
The process is carried out by first cleaning the face of the glass plate which is to contact with the gelatin. The glass may be cleaned by using rouge or tripoli in suspension in water. The glass is then dipped in a bath of ethyl alcohol and applied on either side of the sheet of gelatin. The assembly is then subjected to heat and pressure in a press. The heat softens the gelatin and the pressure causes it to adhere to the glass. Instead of using ordinary gelatin, there may be used gelatin which is bleached and rendered supple and tenacious by incorporating albumin, fibrin and protein or nitrocellulose.

When celluoid is used as a reinforcing layer an aqueous solution of gelatin is formed on the well cleaned glass plates, which is allowed to drip so as to form a very thin adherent film. The glass plates are then dipped in alcohol and a sheet of celluloid is interposed. The assembly is then submitted to heat and pressure.

The edges of the finished sheet are luted by rendering the gelatin insoluble. This is accomplished by dipping the glass for three hours in a saturated solution of bichromate of potash. The gelatin becomes hardened at the edges for a distance of about two millimeters. By exposing the edges to formal, the gelatin can also be hardened. The cutting can also be effected by applying paraffin or pitch along the edge of the composite glass.

Another Gelatin Patent

In patent 1,210,987 a sheet of ordinary glass is first cleaned thoroughly, the clean surface is then coated with a solution of gelatin or other suitable transparent gelatinous substance and thereupon a solution of cellulose material is applied at least one of the solvents having a solvent action upon both the gelatin and the cellulose materia. The glass sheet may be cleaned with the aid of any suitable scouring material such as a scouring soap and operation may be performed either by hand or by a machine. It is important, if the best results are desired, that dirt of any kind and especially that of a greasy nature be wholly removed and that a polish be given to the glass as by rubbing with a clean, dry cloth. A gelatin solution is prepared in any suitable way, as for example by dissolving pieces of sheet gelatin in formic acid (sp. gr. 1.20), the best proportions known being 7 parts gelatin to 93 parts formic acid, and then filtering through a filter paper. Instead of formic acid any other solvent of gelatin may be used which also has solvent action upon the cellulose material subsequently to be used. The gelatin solution may be of practically any strength. A solution containing 2% gelatin is preferable over a strong solution, say, a 15% solution because it pro-



By Courtesy of Libbey-Owens Sheet Glass Co.

UTILITY OF LAMINATED GLASS

Two views of a car equipped with standard Libbey-Owens non-shatterable laminated glass, belonging to Dr. George B. Watkins, one of that Company's research men, who, with his wife, were in an automobile accident a few weeks ago. They were traveling about 35 miles an hour when a car coming in the opposite direction at about 50 miles an hour hit the left side of Dr. Watkins' car, and turned it nearly completely over. It rested momentarily on the upper right-hand edge of the top, then rebounded and lay flat on its left side. None of the windows shattered, and only one light in the right-hand door was cracked. This door was pointing skyward when the car came to rest, and Dr. Watkins lowered the sash so that he and his wife could climb out. Several people in the other car were severely cut by flying glass from their own car.

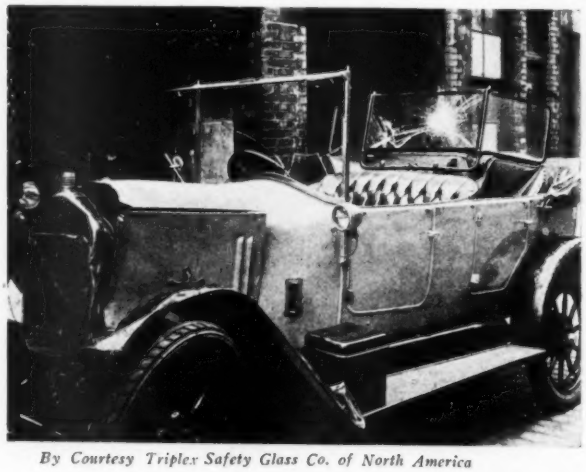
duces a desirable thin film on the plate. The gelatin solution may be spread upon the clean glass in any suitable manner. For example, it may be poured upon and flowed uniformly over the glass, the excess being poured off one corner of the plate and then set up on edge to drip. While so arranged the formic acid or other solvent will evaporate leaving a thin film of gelatin strongly adhering to the glass. When partially dry, that is dry enough so that the

By Courtesy Pittsburgh Plate Glass Co.

THIS PIECE OF DUPLATE LAMINATED GLASS FELL 850 FEET FROM AN AIRPLANE ON HARD GROUND AND WAS ONLY CRACKED

film may be touched by the finger without adhering, which condition obtains after a period of time varying from less than a half hour to several hours, depending on the moisture of the air, the glass is ready for the next coating of cellulose material. The cellulose material may be prepared by dissolving 17 parts of celluloid in small pieces in a suitable solvent, such as acetone, in which case 44.25 parts of acetone may be used, and adding to it, mixing thoroughly meanwhile, a solution of camphor in a suitable solvent for instance such as may be made by employing 3.35 parts of camphor and 35.4 parts of denatured alcohol. The mixing of the solutions should be continued, their temperature being preferably maintained at not exceeding 50° C., until a homogeneous mass has been formed; the mass is then filtered, as by being forced through a felt and silk filtering material by air pressure, and a viscous product is obtained.

The viscous solution of cellulose material, prepared in any of the above indicated ways, is now placed upon the gelatin film and spread in any suitable manner; the coating of cellulose material, and the first coating of gelatin also may be applied by hand or by suitable mechanism. The amount of material used is preferably such as will completely cover the plate when in a horizontal position and will overflow if more is added. The plate is now allowed to stand on a leveled table in an atmosphere of a solvent and out of contact with moisture. This may be accomplished by surrounding the plate by a glass-topped frame, the spaces between the frame sides and the cellulose covered plate being occupied by troughs containing acetone and dry, fused calcium chloride. When thus allowed to stand for about four hours the viscous cellulose material will flow to produce a level surface of clear cellulose solution. The frame may then be removed to allow the cellulose solvents to evaporate. In a short time after the removal of the frame, the cellulose material may first be opalescent, but this condition gradually disappears as the solvents evaporate, leaving the film clear and transparent. After standing exposed to the air for about twelve hours the composite plate is removed to a suitable drying chamber and kept there for about three days, being subjected meanwhile to a bath of air at about 20° to 40° C. The solvents are thus removed and the plate is now in a finished condition and may be used either alone or combined in any suitable manner with a protective material such as a second glass plate. For example, if two similar plates, prepared as described, are desired to be combined, the cellulose surfaces of the two plates may be placed in contact and the edges of the plates cemented together in any well known and suitable fashion. If it is desired to produce a



By Courtesy Triplex Safety Glass Co. of North America

A GIRL IN THE FRONT SEAT ALMOST SEVERED HER JUGULAR VEIN. THE FRONT WINDSHIELD WAS ORDINARY GLASS, TONNEAU SHIELD OF TRIPLEX LAMINATED GLASS

glass of a particular color a suitable dyestuff may be added to the celluloid solution or to the gelatin solution for this purpose.

A Plate Press

A press for uniting the sheets of glass is described by the Benedictus patent 1,206,656, Nov. 28, 1916, which is illustrated in the accompanying drawings. The invention consists of imparting to these plates or to one of them only a slightly dished or convex shape so as to insure compression of the material extending progressively from the center to the periphery and thus to cause as completely as possible an expulsion of the liquids or fluids retained by the materials subjected to compression. The plates of the press are provided with a cushioning device composed of a sufficiently thick layer of an elastic or compressible material such as cork, felt, caoutchouc, paper, etc., with a

view to transmitting and at the same time moderating or cushioning the forces of compression from the dished or convex face of the plate to the plane surface of the glass and to prevent the breakage of the latter.

Figure 1 is a vertical section through press plates. Fig.

Fig. 1

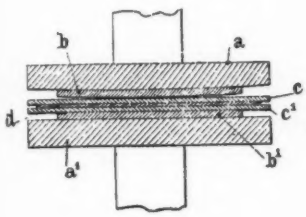


Fig. 3

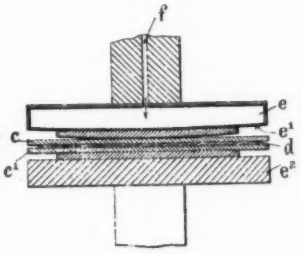


Fig. 2

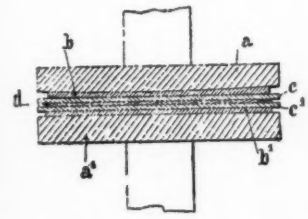
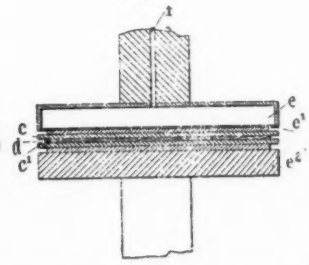


Fig. 4



2 is a similar view of the same under pressure; Figs. 3 and 4 are views corresponding to Figs. 1 and 2, but illustrating the invention applied in a different manner.

Referring to Figs. 1 and 2, the upper press plate a carries on its convexed lower face a mattress of elastic material b, such as cork, felt, rubber or other suitable material. The face of the lower press plate a^1 which is flat, is similarly furnished with a mattress b^1 identical with a^1. As will be readily understood, the sheet d of gelatin, which is confined between the sheets c and c^1 of glass, is subjected to pressure, first at a point beneath the crown of the press plate a, while the pressure gradually spreads throughout the entire width of the mattress b as the latter is compressed by the downward movement of the plate.

In Figs. 3 and 4 the upper press plate e is hollow and its face comprises a flexible sheet e^1 which may be rendered convex by the introduction of fluid through the passage f in the shaft of the press. The lower press plate e^2 is solid and flat and the other elements of the illustration are likewise the same in these Figs. 1 and 2. The operation of this press differs from that shown in Figs. 1 and 2, only in that here the face of the plate itself as well as the cushioning mattress flattens out under the action of the press.

Varnish As a Binding Agent

In carrying out the invention of U. S. patent No. 1,223,135 Apr. 17, 1917, the reinforced glass plates to be united have their juxtaposed surfaces coated with varnish or equivalent material, and under the coating of varnish of one or both plates is a reinforcing film composed of successive layers or deposits of gelatin, celluloid and gelatin. The varnish on the plates of glass is allowed to harden before the union of the plates is attempted, and in order to unite the plates the surface of the varnish is softened by applying a solvent thereto, such as alcohol, and then the two plates are immediately put together and pressed tightly, so that the varnish on one plate will unite with the varnish of the other plate, whereby the plates become permanently united as a single article when the varnish hardens. Obviously, more than two plates may be combined together in this manner with reinforcing material between each pair of adjacent plates. A simple method of performing the process is to dip the coated plates in a bath of alcohol or equivalent solvent, and while in the bath press the plates together as tightly as possible, and then finally remove the plates from the bath and still further press them together so as to force out from between the plates any excess alcohol, and also to tightly combine the plates.

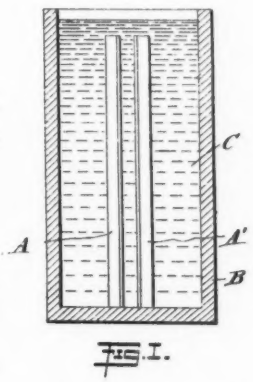


FIG. 1.

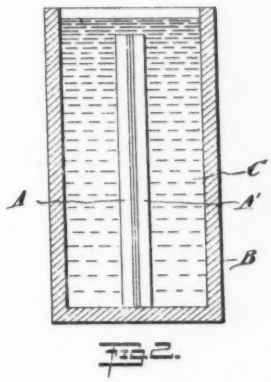
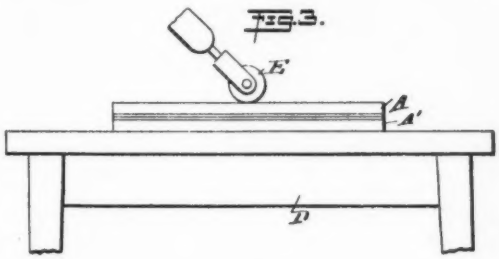
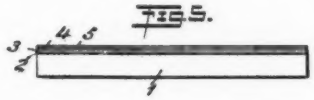


FIG. 2.

Figure 1 is a sectional view of a tank of alcohol with two plates immersed therein but out of contact; Fig. 2 is





a similar view showing the plates pressed together; Fig. 3 is a view showing the plates removed from the bath and being finally pressed together to exclude air and alcohol from between the plates; Fig. 4 is a sectional view of a triple-plate reinforced glass; and Fig. 5 is a sectional view of a plate of glass showing the various layers that go to

make up the reinforcement. Referring first to Fig. 5, it will be observed that the plate of glass 1 is provided with superimposed layers of gelatin 2, celluloid 3, gelatin 4 and varnish 5.

The process of uniting plates of glass reinforces consists in dissolving only the surface of the outer coating of the reinforce, namely, the varnish 5, and then pressing two or more plates together so that the varnish of one will unite or coalesce with the varnish of the adjacent plate, whereby a permanent union is effected. The softening or dissolving of the surface is effected by placing the varnish-coated plates A and A^1 in a tank B containing alcohol or equivalent liquid C. The alcohol acts on the surface of the external coating of the reinforce to soften the varnish slightly, and while the plates are in the bath they are pressed together as shown in Fig. 2. The plates are then removed and subjected to further pressure for more intimately uniting the varnish of one plate with that of the other. Any suitable means may be employed to perform this step. For instance, the plates are placed on a table D, Fig. 3, and a roller or equivalent device E run over the top plate A, for pressing it against the under plate A^1. After this operation the plates are set away to allow the varnish to thoroughly harden. It is to be understood that only one of the plates need be provided with the reinforcing coating of celluloid and gelatin and an external protective coating of varnish, and the other plate need have only varnish so that it will unite with the varnish of the reinforced plates.

The method of uniting a plurality of plates may be adapted for a triple-plate glass as shown in Fig. 4, wherein the several plates are designated by the character 6, and the reinforcing coating by the character 7. It will be noted that the intermediate plate 6 is coated on both sides while the outer plates are coated only on their inner faces. Obviously, a multiple-plate glass embodying more than three plates may be made as described.

Glucose As Binding Agent

The simplest form of the invention of U. S. patent 1,224,530, May 1, 1917, comprises two panes of glass or a similar transparent fragile material, and a transparent retaining film or sheet of a suitable tough adhesive and resilient cement or similar material such as glucose arranged between the plates of glass so as to adhere firmly thereto and form practically an integral part thereof. This retaining film may be applied to the opposing sides of the plates of glass while in a freely liquid state and then allowing it to dry to a viscous condition.

Instead of depending solely upon the transparent film for holding the fragments of glass together in the event that the glass plates are cracked or broken, a supporting plate of non-fragile transparent material such as celluloid or mica may be arranged between two glass plates and transparent films of cement of the character described may be interposed between opposite sides of the supporting plate and the glass plates.

A further modification of this construction consists of two transparent supporting plates of any suitable non-fragile material such as celluloid or mica are arranged side by side between two glass plates and a central transparent film of cement is arranged between the opposing sides of the two supporting plates, and two transparent films of cement are arranged between the transparent supporting plates and the glass plates, the several members being connected adhesively with each other.

The Bardin Process

According to U. S. patent No. 1,228,165, May 29, 1917, to Abel Bardin the glass to be reinforced is first washed carefully, for example by the aid of iron oxide in suspension in water. Then the glass is dipped into a 20 percent solution of chromic oxide in water to destroy all traces of grease. It is then rinsed in running water, and dried.

The glass so cleaned then receives a transparent, adhesive coating, which is preferably a weak solution of gelatin projected on to one of the glass faces in such a manner as to produce thereon an extremely thin film having the thickness of about .03 of a millimeter.

When the gelatin film is dry, a transparent reinforcing solution can be poured over the film, but preferably the gelatin film is first coated with a solution intended to improve the adhesion of the reinforcing solution and consists of one or two percent of collodion or celluloid or simply nitro-cellulose dissolved in ethyl formate. When this latter coating has solidified it may happen that a haze is produced by the coating. The haze is made to disappear by the application of the following solution, also obtained by vaporization:

Celluloid	2 to 3	grams
Acetone	30	cubic centimeters
Ether	30	" "
Amyl acetate	30	" "
Amyl alcohol	10	" "

The above coating is allowed to try, and then a celluloid varnishing and protecting coating is poured on. This pouring on may be effected, for example, by furnishing the edges of the glass with molding strips or with pasteboard strips. To obtain good results, the following solution can be poured on, at the proportion of one liter per square meter of the plate surface:

Celluloid	5 to 15	grams
Ether	30	cubic centimeters
Acetone	30	" "
Amyl acetate	30	" "
Amyl alcohol	20	" "

The following solution is equally suitable:

Celluloid	5 to 15	grams
Acetone	45	cubic centimeters
Amyl acetate	45	" "
Amyl alcohol	10	" "

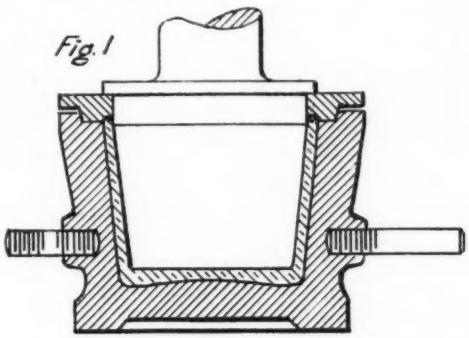
In each of these solutions, the quantity of celluloid given as example may vary, especially according to the quality of the materials employed. After the plates are perfectly dry, their edges are covered with a suitable impervious varnish to prevent the action of steam, water, or external agents. Bichromated gelatin or other suitable product may also be utilized for this purpose.

(To be continued)

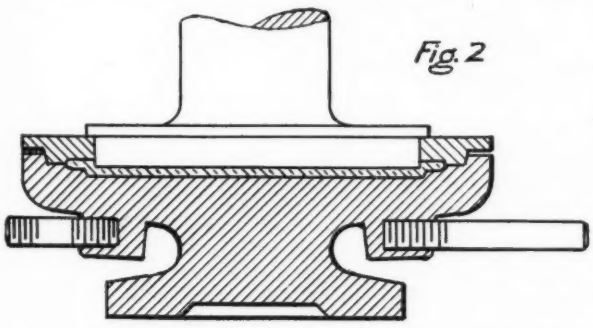
The Construction of Common Types of Press Molds

By Roy E. Swain[1]

THE press mold although very simple and sturdy in design requires very accurate and delicate workmanship on the part of the mold maker to produce a satisfactory mold. The simple shapes of glass are made in block molds but special shapes and conditions have given the mold designers many opportunities to work out some very ingenious molds



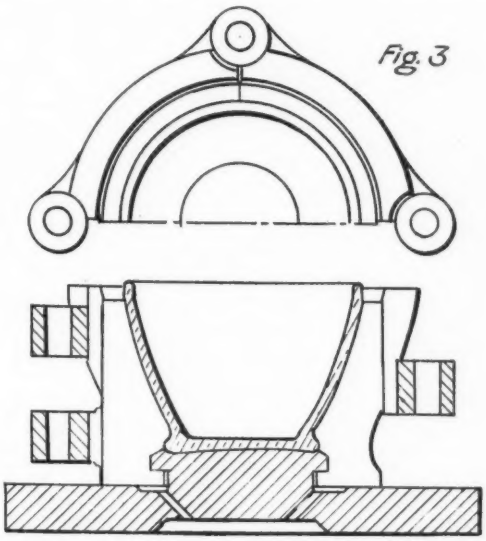
and attachments. As many workmen have learned to work but two or three types of molds it is often very difficult to introduce new types, with the result that many good molds have been shelved rather than spend the amount of time necessary to train a shop to operate them. Mold designers are consequently discouraged in developing the newer ideas



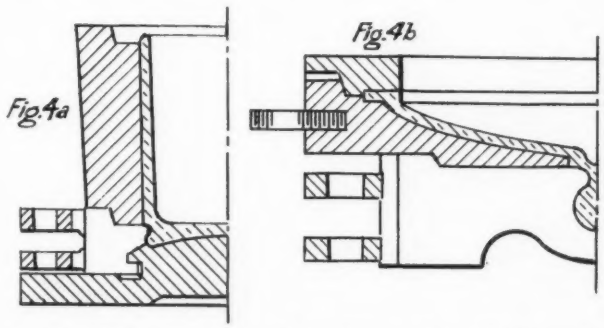
and usually reject shapes unsuited to the particular types of molds used in their plants.

The block mold is the least complicated of molds and is illustrated in Fig. 1. The pedestal type is not essentially different from the block mold. It is generally more satisfactory for flat articles as it provides greater handle space for the presser and temperature control is less difficult. Fig. 2 represents a cross section through a pedestal type mold.

Articles having figured designs or shapes that do not permit delivery from block molds are made in sectional molds that are designated as two part, three part, or four part according to the number of vertical sections. The plan of a four part mold is shown in Fig. 3. Many articles are made with projecting rings about the bottoms to engage the finisher's snaps but do not carry designs to hide the seams caused by the joints of the full sectional molds. Such articles are made in shell type molds having sectional bottoms as shown in Fig. 4a. In working these molds the shells are usually removed from the bottom plate and inverted to discharge the ware but may be provided with valves for lifting the finished articles to a position that will permit them



to be engaged by a pair of pincers or a fork provided for handling the ware. This mold made for shallow articles as shown in Fig. 4b is usually provided with two, three or four shells and the shells worked in rotation. In another type of sectional mold the sections are fitted into a housing and the ware is discharged by raising the valve. This mold has been developed for shallow ware and for machine use as shown in 4c. and 4d. The 4d mold has the advantage over



the 4b mold in as much as a flat article can be made in it and ample metal can be provided in the mold to insure strength and heat balance. In these molds the pressure of the spring plate closes the mold so that the joints will close tightly re-

[1]Engineering Department, Macbeth-Evans Glass Co.

gardless of the temperature of the mold while in hinged molds it is necessary to provide so much clearance on the joints to prevent binding when hot, that the joints will stand open when the mold is worked cold.

In Fig. 5 is shown a more complicated mold that may be used to illustrate two features of mold design, the lift off

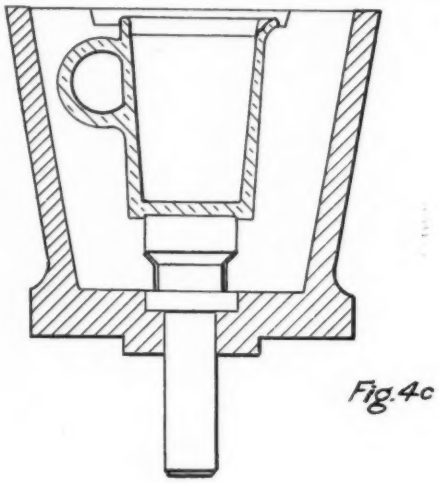
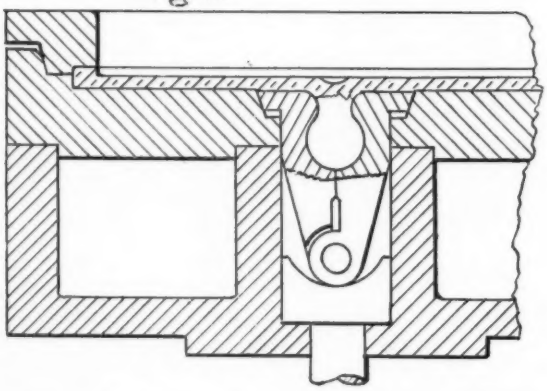


Fig. 4c

Fig. 4d



cylinder and the "shovey up" valve. The lift off cylinder is simply a deep ring that extends down to form the greater part of the article. The reason for having these valves so mounted is to be able to withdraw them from the glass as soon as the article is formed to prevent the glass shrinking on the metal so that it cannot be removed.

In Fig. 6 three additional mechanisms are shown for operating the valve or plunger as it may be called. None of these have been as popular as the one shown in Fig. 5 as it provides a greater movement and is comparatively simple inexpensive. Fig. 6a shows a plunger operated by means of a screw while in Fig. 6b is shown a valve operated by means of an eccentric. Both of these depend upon the presser to provide the movement of the operating lever but in Fig. 6c the operation of the valve is automatic and follows the withdrawal of the plunger from the mold.

The valves as shown in Figs. 5 and 6 are not always used in the vertical position but may be used to produce an indented design or lettering as for instance a trademark in the side of an article made in a block mold In these the movement is slight and may be made to operate automatically by providing an attachment to the ring or spring plate. Fig. 7 shows this type.

Another method of quickly removing the valve from the lower indentation has found a wide use in the manufacture of mugs, fruit juice extractors and similar articles. A mold employing this method is shown in Fig. 8. This mold is provided with a number of shells and a greater number of plugs and these are worked in rotation. The ware is lifted out on the shell and remains there to cool while a cooled plug is substituted for the hot plug in the mold and a cooled shell is placed in the mold for the forming of another article.

In looking over a counter display of salad plates one might presume these to have been made in very simple molds, but upon careful examination there will be found indications that several types of molds have been used and none quite satisfactory as a straight press article. The plate pressed as a bowl and finished is too expensive to compete with the straight pressed ware. The shape of the plate has been altered to make it conform as nearly as possible to good mold design but the results are rather discouraging. Four of the most prominent of these molds are shown in Fig. 9.

On the side lever press using block molds the molds are inverted to discharge the ware, but with the development of the "turn table" or "merry go round" presses some better method had to be devised for this purpose. The most common method of doing this is to provide the mold with a valve that may be raised to lift the ware out of the mold. The earlier of these valves were provided with tapered seats but the cylinder valves are now used almost to the exclusion of the tapered valves. These valves usually cover the bottoms of the mold hiding their seam in the design of the article, but the larger valves are more difficult to fit so it has been found advantageous to provide the larger molds with a very small valve in the center, and providing a design to cover the valve mark where it is considered objectionable. (See Fig. 10)

Another method of removing the ware is known as the "lift out ring." This ring forms a part of the article and is not unlike some of the shells previously mentioned except for the depth of the ring and its purpose. Where the design of the article permits, the ring may be solid and the ware removed by inverting the ring or in case the article is so shaped as to make it impossible to pass the article through, threads may be provided in the ring and the ring removed by turning. Should these threads not be necessary to the usefulness of the article they may be made very steep and so arranged as to produce a decorative effect. There is also the sectional ring that may be used to deliver designs not adaptable to solid rings. Fig. 11 shows how these rings are placed on the mold and from the design the operation can readily be worked out.

The inverted mold has been used for two purposes. First, as a substitute for the spring bottom mold shown in Fig. 6c and later for the purpose of securing for the mold side of the ware the better finish that is imparted to the article by the plunger. It may here be recalled that the plunger side of the article is formed quickly and is in contact with the

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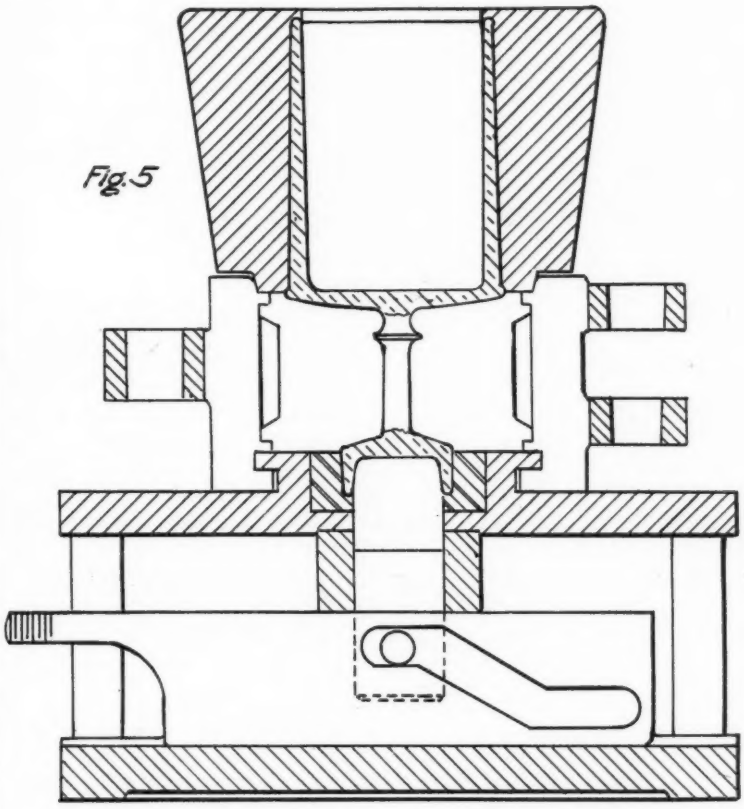
Fig. 5



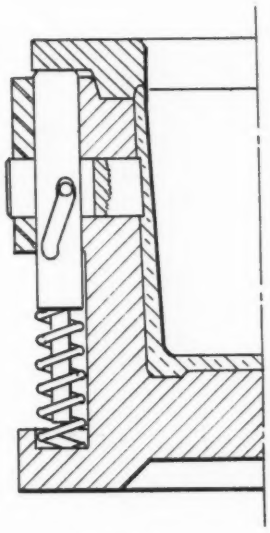
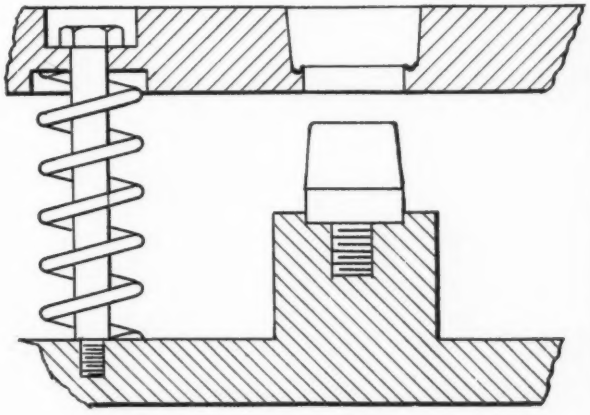


Fig. 7

Fig. 6c



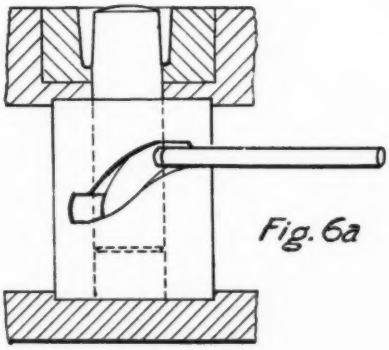


Fig. 6a

Fig. 6b

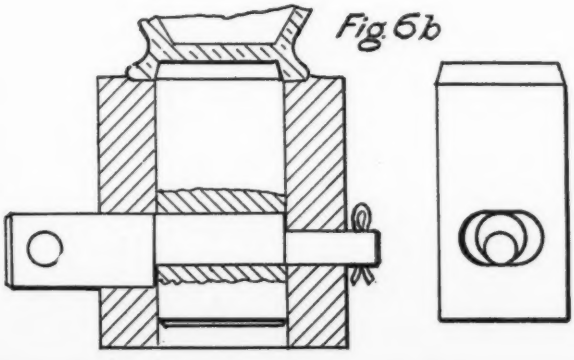
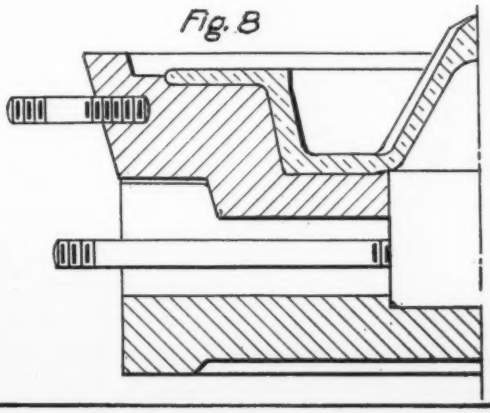


Fig. 8



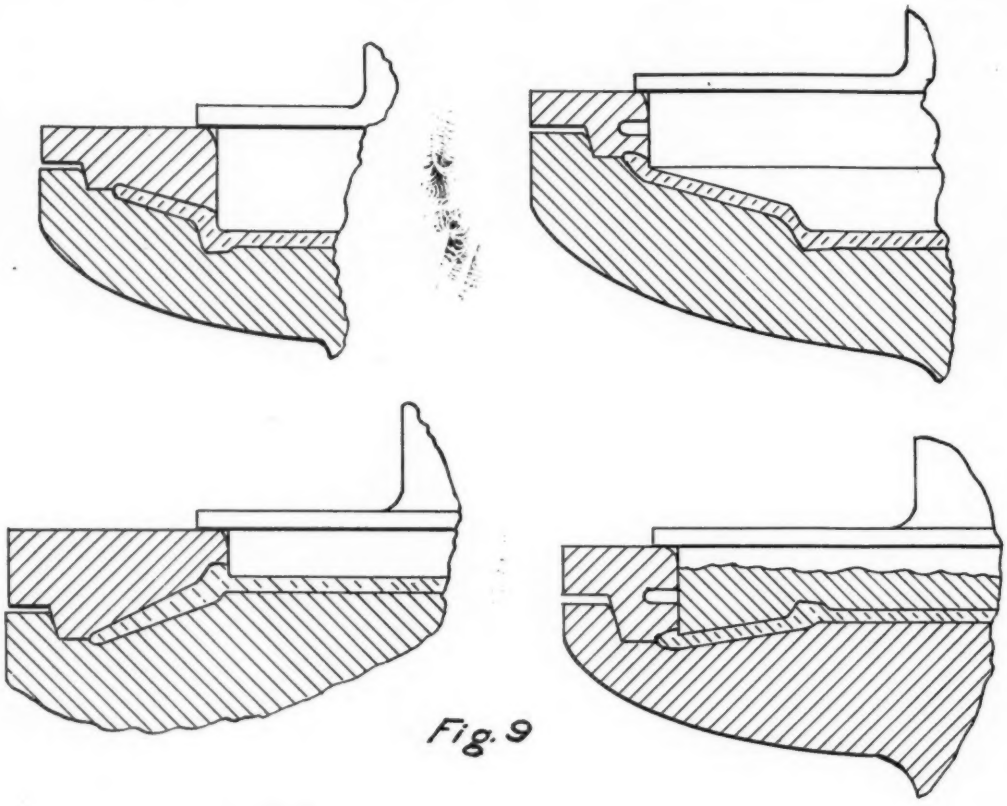


Fig. 9

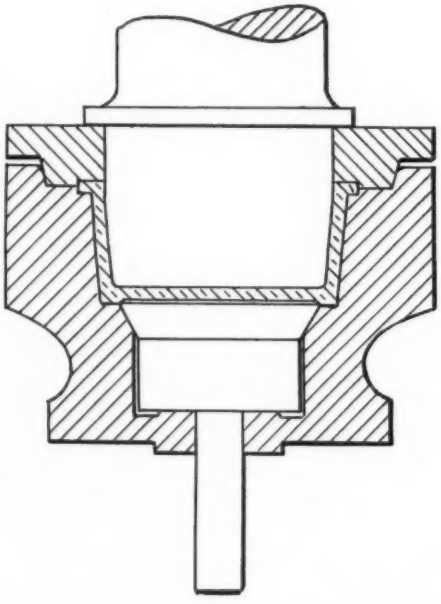
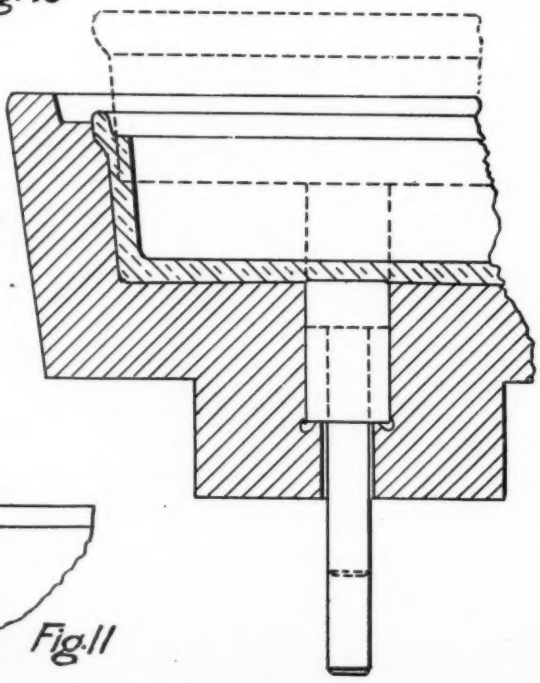


Fig. 10



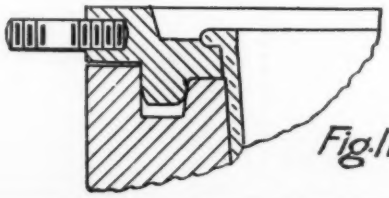
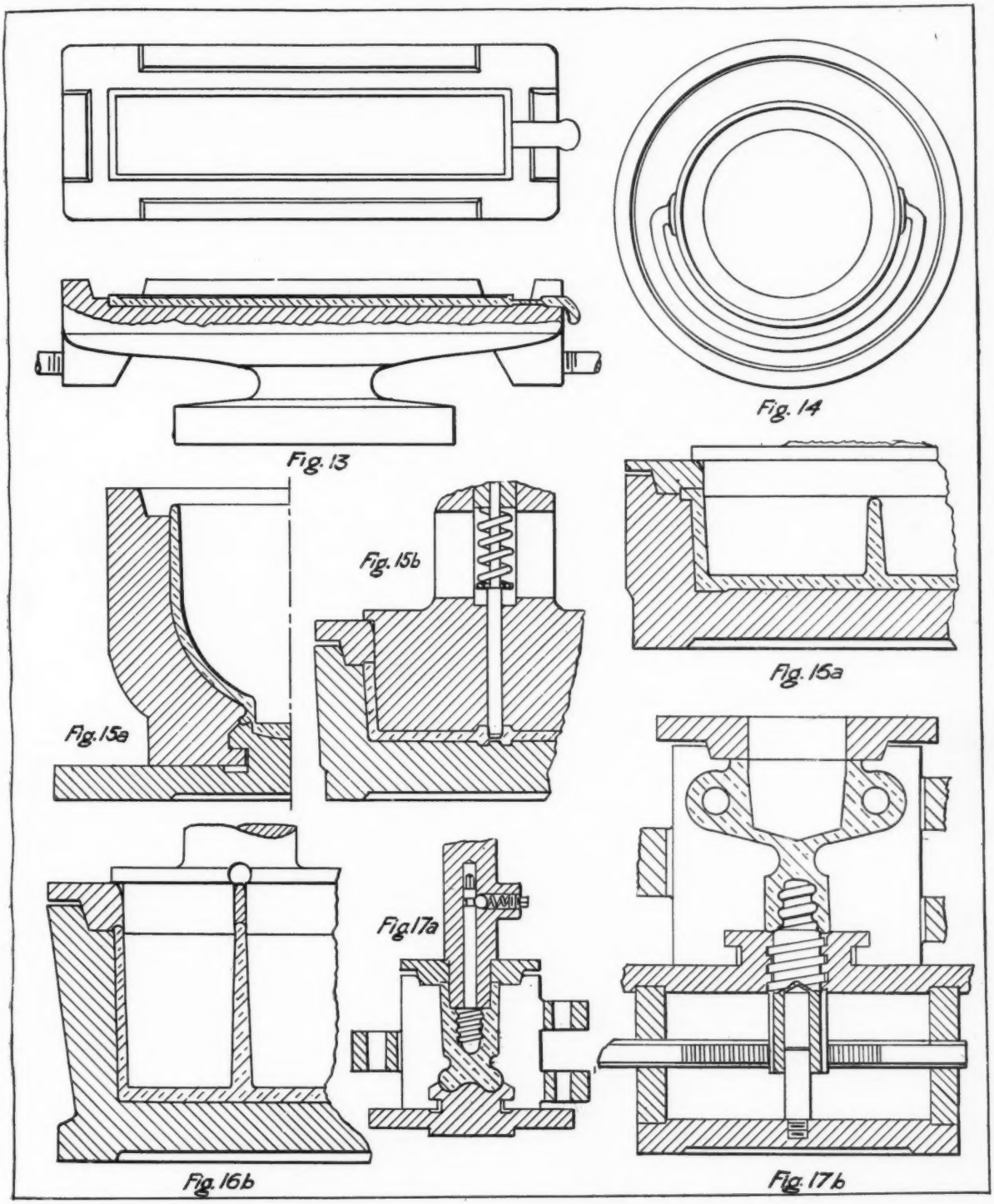


Fig. 11



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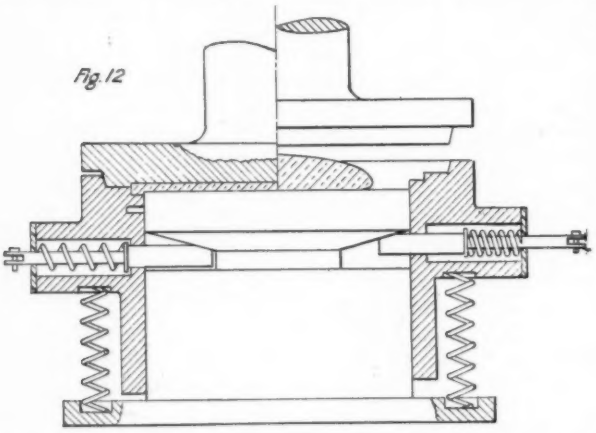
plunger but an instant. This procedure permits the surface to reheat and in this way restores much of the natural brilliancy of the glass. For the same reason the plunger side of the ware is practically free from chill, "hot spot," falling dust that collects on the mold and other defects of a similar nature. Figure 12 (page 12) represents the essentials of this type of mold.

Due to fixture dimensions, color requirements, etc., the customer may be unable to permit the variation in thickness of the article that is necessary in hand gathered ware. To provide for such cases overflow type molds have been devised. In these molds a spillway is provided that while allowing the excess glass to escape is small enough to create enough back pressure to insure the filling of the mold. Spillways or overflows may be provided in molds that have

a tendency to fill unevenly and pressure check the article. The objection to the use of a mold of this type is the necessity of finishing the article at the point where the excess glass is removed. One familiar with mold construction can readily visualize a mold provided with a spillway as represented in Fig. 13.

A great many peculiar designs may be formed between the mold and the ring as for example, lugs for attaching



handles on buckets or handles on flower baskets. Fig. 14 is a plan of a block type mold provided with a groove for producing a simple handle. From this, the principle used can be understood and worked out to apply to the more complicated molds. In finishing these baskets the handles are bent to the desired position and shaped.

To produce a completed article having a perforation near the center has been very difficult but many ingenious methods have been devised to assist the finishing department to produce these openings. Certain types of reflectors and vinegar cruets have been made by pressing and finishing by cutting down and knocking the bottom out of the blank. Fig. 15a represents a mold for making ware of this type. When very small openings are required an auxiliary spring loaded plunger may be used. This plunger has the advantage of being able to reach its objective ahead of the plunger proper and thus force the maximum of glass out its path before the pressing pressure is brought to bear on the glass. In this way the intervening glass is pressed thin and strained so badly that it may easily be knocked out by means of a file tang or similar instrument. Another advantage is that variations in the weight of the article do not appreciably change the thickness of this film of glass as it does when the same type of ware is made by means of a solid type plunger. In Fig. 15c a cross section is shown of a mold of this class.

Many articles having a number of compartments have been made by pressing. In Fig. 16 we have cross sections of the upper parts of two molds showing slightly different methods of producing these partitions. In Fig. 16a the groove is cut in the plunger so that the edge of the partition is formed in the plunger while in Fig. 16b the groove is carried to a point above the ring and an extension of the ring forms the edge of the partition. This later method makes it possible to produce partitions flush with the sides of the articles and prevents variations in the height of the division due to the unequal weight of the gathering.

Glassware requiring an internal thread such as used in insulators is usually made by means of a threaded auxiliary plunger or plunger attachment. This is held in a cavity in the plunger proper by means of a friction device and is left in the article when the plunger is removed. At the next station it is removed by turning. Occasionally an article requiring an internal thread may be of a design that may be formed in a mold by means of a threaded plug operated as a "shovey up" valve as shown in Fig. 17b.

Some articles are so shaped that it is impractical to shape them in a single mold but may be made in sections. In one mold a cavity is provided into which the first part pressed is placed where it forms a part of the mold for the second part. Upon pressing the second part, the two parts are fused together and delivered from the mold as one piece. Or it may be a case of a blown bowl requiring a pressed foot. This can be done in the same manner using the blown article as a part of the press mold. However, it is better practice to place the pressed foot in the blow mold as the heavier pressed article is better able to remain out of the lehr for the extra operation.

In this article we have considered but a few of the outstanding molding devices developed by the mold designers in an attempt to produce the great variety of shapes that the users of glass have devised. One type of press mold has not been considered as it can best be handled as a separate subject. That is the font or well type mold which has little in common with straight press ware and many features and developments of its own.

Stem Ware

In stem ware unless there is a constriction near the bowl the stem will usually feed from the bowl or plunger end of the stem, producing an indentation or well in the bottom of the bowl. This surface produced by the plunger quickly reheats and offers little resistance to the pull of the contracting interior of the stem.

Handles also have a tendency to do this. In some of the cheaper wares one may find handles that have piped as much as a quarter of an inch.

In some of the solid pieces where the manufacturer has sought to cut expenses by doing away with the font and making the job straight press, one may find piping a half an inch in diameter by an inch or more in depth. Should he set the surface enough to prevent the piping, magic blisters will appear.

This piping is often very pronounced in strain insulators, flower blocks, drawer pulls, etc., where a hole is formed in a heavy piece of glass by pressing glass around a pin. These holes in the finished ware are usually much larger than the pin formed in them.

Wrinkles in press ware are formed when the glass or mold is cold. They may be reduced by making the molds relatively light in the section affected.

The problem of deformed glassware is but one of the problems which owes its origin to the unequal cooling of the glass in manufacturing, for it is from this source that we get our annealing problems.—*Roy E. Swain.*

Unexpected Influences May Determine the Lives and Careers of Individuals

Personal Reminiscences of The Libbey-Owens Sheet Glass Company

By Wm. S. Walbridge[1]

THIS may appear as a strange introduction to The Libbey-Owens Sheet Glass Company's developments, but as the story[2] opens out we believe that you will agree with our statement.

The names "Libbey" and "Owens" are those of two men who came together from different walks of life—one as a manufacturer, the other as a workman and inventor, closely cooperating in the development and manufacture of glass. They changed conditions which existed from the era of the Phoenicians and Egyptians, and they are recognized by the glass world of this century as two of the most advanced men of the period. Furthermore, they became close friends and their lives closed within a short period of each other.

Edward Drummond Libbey was of English-New England descent, one of his ancestors, Richard Warren, being among the Mayflower Pilgrims, the other, John Libbey, emigrating from England in 1630 and settling at Scarborough, Maine. Mr. Libbey's early history was much the same as that of any normal American boy with educational opportunities such as were afforded in New England. At the age of twenty he associated himself with his father in the manufacture of glass at the New England Glass Company, East Cambridge, Mass., in 1874, and following his father's death in 1883 he became the sole proprietor of the business. It was through the manufacture of Amberina Glass, a development of the company at the time of his father's death, that Mr. Libbey started on an upward career which terminated only with his death.

Amberina Glass was the foundation, and it may be interesting to note that this glass was a new development in tableware—the color ranging from a ruby to a straw color, beautiful in design and finish. It first made the name "Libbey" prominent in the glass world.

Libbey's career was progressive up to 1887 when labor troubles developed with the advent of a labor delegate from the West. Strange as it may appear, this delegate was none other than Michael J. Owens, then unknown to Libbey. Owens was to appear again later, after a number of years, without being identified with his original role.

This referring back to the heading of this article, was the "Unexpected Influence" governing the lives of both Libbey and Owens.

As a result of the labor demands not being met, The New England Glass Company was closed permanently and Libbey's next operation was at Toledo, Ohio, in 1888.

Again, labor conditions were unsatisfactory. The workmen brought from the East were dissatisfied and leaving. New men had to be obtained to fill their places. Along with other new men, Libbey employed Owens, still unknown, as a castor-place workman, that is, as a skilled workman capable of directing a small group.

Before getting into the intimate story of Libbey and Owens, we think that a short story of Owens' life up to this point may be interesting in contrast to the life of Libbey.

Owens was the son of emigrants, from County Wexford, Ireland, who came over in the early 1840's. His father was employed as a coal miner, and "Mike," as everybody knew him, was born January 1, 1859, in Mason County, Va. At the age of ten, his parents having moved to Wheeling, W. Va., Mike got a job as "carry-in" boy at Hobbs and Brockunier's factory, and at fifteen he was a glass-blower in a small way. He remained at this plant until 1888 when he went with Libbey.

This may be considered the beginning of relations between Libbey and Owens, which terminated only with Owens' death in 1923. They began as employer and workman—later to become close associates and friends, the one furnishing the capital and organization—the other, inventive genius and management—both essential elements.

A short time after Owens' employment by The Libbey Glass Company, he went to see Libbey and told him that he was going to quit his job.

"What's the matter, Owens?" Libbey inquired.

"You don't know how to run your business," was the reply.

"What do you mean, Owens, by that statement?" was Libbey's response.

Owens replied, "There's no discipline in the factory."

"I know that," Libbey answered. "Look here, Owens, will you take the job?"

"You don't mean it," said Owens.

"I do mean it," Libbey replied.

"Let me think of it over night," Owens came back.

The next morning Owens came into the office with the remark, "I'll take the job, Mr. Libbey, if you'll keep your hands off!"

"All right," said Libbey, "Go to it."

Two days later Libbey went into the factory and found that not a man was at work.

"Look here, Owens," he asked, "where are the men?"

"I've fired them," Owens replied.

"Fired them!" Libbey said, "How are you going to run the factory?"

"Oh, I'll get back the ones I want."

So he did and from that time forward, order came out of chaos. Owens was a strict disciplinarian and the men knew it.

(*Continued on page* 15)

[1] Vice-president of The Toledo Glass Company.

[2] This story (not reprinted here) was written by H. E. Allen of Libbey-Owens Sheet Glass Company, and appeared in *The Engineer*, published by Lockwood-Greene Engineers, Inc., New York, December, 1928, issue.

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We Heartily Wish All of Our Readers A Very Happy and Prosperous New Year

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CONTENTS

	Page
The Manufacture of Laminated Safety Glass	1
The Construction of Common Types of Press Molds	7
Unexpected Influences May Determine the Lives and Careers of Individuals	13
Editorial:	
Borax	14
Color Facts	14
"Glass Craft Sculpture"	17
Knox-O'Neill Suction Feed Bottle Machine	18
Recent Patents	19
Fine Program Awaits Glass Division Members (Annual A. C. S. Meeting)	20
What Will Congress Do About the Tariff?	21
Tariff Commission Discusses "Flexible" Provisions	21
Purchase of Celite Products Company Completed	21
Electric Furnace Temperature Control	21
The Glass World and What It Is Doing:	
Byrd Distributing Owens' Bottles	22
Eleven Months' Construction Record	22
Mirror Manufacturers' Pittsburgh Meeting	22
Investigation of Meat Packaging in Glass	22
Engineers Will Visit Kingsport	22
Eleven Months' Plate Glass Production	22
Glass World and What It Is Doing	22
Industrial Publications	23
Personals	23
Recent Deaths	23
Coming Meetings	23
What the World Wants	23
Inquiries Received	23
Glass Stock Quotations	23
Readers' Wants and Offers	23
Current Prices of Glassmaking Materials	24
Monthly Summary of U. S. Foreign Commerce in Glass	24

CLASSIFIED BUYERS' GUIDE, PAGE 22
INDEX TO ADVERTISEMENTS, PAGE 24

Color Facts

Hue is the identification or "color" of a color. When you change red to red-orange, you have changed the "hue."

A shade is any tone deeper than the normal or spectrum tone of a color.

A tint is a tone lighter than the normal or spectrum tone of a color.

Value is the term used to designate the light or dark quality of a color. A shade is a dark value and a tint is a light value.

A neutralized color is a grayed color.

The intensity of a color refers to its brilliancy. As a color becomes neutralized, it loses its intensity.—*Color-Craft.*

Borax

One of the most notable price changes affecting the cost of glass making has been the sharp drop in the cost of borax. This has been due to two causes, which arrived almost at the same time. One is the discovery of immense deposits of a new mineral, the previously unknown hydrate of sodium borate, containing four molecules of water, which has been named "Rasorite" in honor of its discoverer, C. M. Rasor, field engineer of the Pacific Coast Borax Company. When brought into full production, this deposit, it is said, will have a productive capacity equal to the entire world's consumption of borax at the present time.

The other addition to the sources of borax which has become effective during the year is due to the solution of the manufacturing problems in producing this substance from the waters of Searle's lake, by the American Potash and Chemical Company. Great credit belongs to Dr. John E. Teeple, and his co-workers, who are largely responsible for the results obtained.

The Company has invested over ten million dollars in this enterprise, upon which a profit is now being realized, with every prospect of a large increase of earnings, within the next few years.

The properties of boron as a constituent of glass were first studied by the English clergyman-scientist Harcourt. It belongs to the fame of Otto Schott to have proven the great advantages of borax in glass, who included this element in his "Jena" glass. As is well known, Pyrex glass would be impossible without this constituent. It is well known that boron improves the durability of glass, that it heightens lustre and increases the refractive index.

Now that the price of borax has dropped to about fifty dollars a ton, it has become a material that should have serious consideration from every glassmaker, as it can be applied to almost every kind of glass, with some definite object in view.

One of its greatest advantages, in these days of mass production, is the possibility of increasing the capacity of a tank, without the danger of the formation of seeds, as a result of too much speed.

Consulting Chemists and Engineers Organize

A group of the leading professional consultants representative of all branches of chemistry and chemical engineering met recently at the Chemists' Club in New York to perfect the organization of the Association of Consulting Chemists and Chemical Engineers.

The situation was thoroughly discussed by a number of prominent consultants. Dr. Alvin C. Purdy said "The reason industrial progress in Germany has been so rapid, while no doubt partly the result of constant and thorough application is, nevertheless, largely due to the fact that over there they constantly draw upon chemical engineering knowledge for help in every kind of industry, while here many of our business men are still under the spell of the delusion that chemistry is only helpful where chemicals and drugs are concerned. As a matter of fact many of our alert business now realize the versatility of the chemical engineer who perfects old, and creates new materials; who selects the most

efficient equipment, recommends better and less costly raw materials; and simplifies processes. It is he who turns waste nuisances into profitable by-products and it is his advice that is more and more being sought and relied upon not only by industrialists but also by investors and bankers."

Unexpected Influences

(*Continued from page* 13)

The next big event was the World's Fair, Chicago, in 1893. Libbey built a factory there and Owens ran it with good results.

Libbey next took a needed rest in California and Owens went back to the Toledo plant. On Libbey's return, Owens put up to him his first big invention—a machine for blowing tumblers semi-automatically.

The Toledo Glass Company followed, operating these machines—Libbey, President; Owens, General Manager.

Next came the American Lamp Chimney Company, operating the same machines, followed by the Macbeth Evans Glass Company, which took over the American—Libbey as Vice-President, Owens as Superintendent.

Here were developed the automatic machines for bottles, and, later, came The Owens Bottle Machine Company—Libbey, President; Owens, General Manager.

It was in 1912, when operating the bottle plant, that Owens became attracted by the Colburn patents on a window-glass process which had been operated unsuccessfully and which were offered for sale by the receivers.

More to please Owens than for any other reason, Libbey authorized the purchase of the Colburn patents and here was the beginning of "The Libbey-Owens Window Glass Company."

We will digress for a moment and tell what Mr. Libbey believed to be the secret of his successful career. He was always a believer in a mutuality of interests and he recognized ability and loyalty among his associates and employees.

He believed that men serving his interests should not be permitted to go unrewarded. His scheme was to set aside stock in his companies for the benefit of associates and employees under a liberal plan of purchase. He expressed himself in this way: "As I grow, my associates and employees grow also." A wise plan! His former associates and employees have shared the rewards with him.

In the Libbey-Owens Company, developed under Toledo Glass Company management and financing, the first to receive benefit was Colburn, the inventor, who participated in a large block of stock at the time the Libbey-Owens Company was organized. This was compensation for Colburn's efforts in assisting Owens to develop the window-glass process from where Colburn left off. Other associates and employees were rewarded in the same way.

After acquiring the Colburn patents and after spending over a million dollars, The Toledo Glass Company in 1916 organized The Libbey-Owens Sheet Glass Company.

Next followed a six-unit plant, at Charleston, W. Va., which cost $1,500,000. This plant started running in November, 1917.

The quality of the glass immediately put the company in the front rank and, in 1920, the plant was doubled in size. It was enlarged again in 1923 and other plants were built subsequently at Lancaster, Ohio; Shreveport, La., and in Japan, Belgium, Switzerland, Spain and France.

The close friendship of Libbey and Owens continued throughout the life of Mr. Owens which closed in December, 1923.

While at a directors' meeting of The Owens Bottle Company, Mr. Owens asked to be excused for a moment. He never returned. Stricken with a fainting attack in the corridor of the offices, he expired within fifteen minutes after the attack.

Mr. Libbey continued to guide the affairs of the company until November, 1925, when he, also, was called suddenly from this life.

The company has continued to prosper under able management.

Arthur Raymond Payne

A. R. Payne, Chief Chemist of the Fostoria Glass Company, died suddenly at his home in Moundsville, West Virginia, on December 26, from heart attack. The deceased was born in the State of Illinois in 1891, received his B.Sc. degree from Pomona College, Claremont, California in 1913,

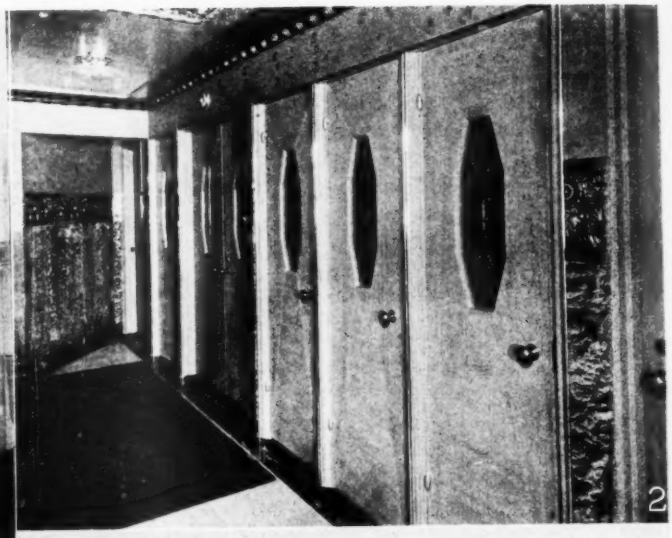
A. R. PAYNE

and the M.Sc. degree from the University of California in 1914. He majored in physics and was an outstanding student. He excelled in athletics, especially in broad and high jumping. For two years after graduation he taught school and from 1917 until 1919 he was connected with the U. S. Bureau of Standards, as physicist, and was in charge of inspection of the optical glass for the Bureau during the war. He joined the Hazel-Atlas Glass Company as Chief Physicist in 1919, and was appointed Chief Chemist of the Fostoria Glass Company about two years ago.

Mr. Payne took a prominent part in the activities of the Glass Division of the American Ceramic Society, of which he was chairman in 1923, and was also a member of the Physical Society. His thorough knowledge of glass technology, his keen analytical mind and his fine personality made him one of the foremost members of the Division.

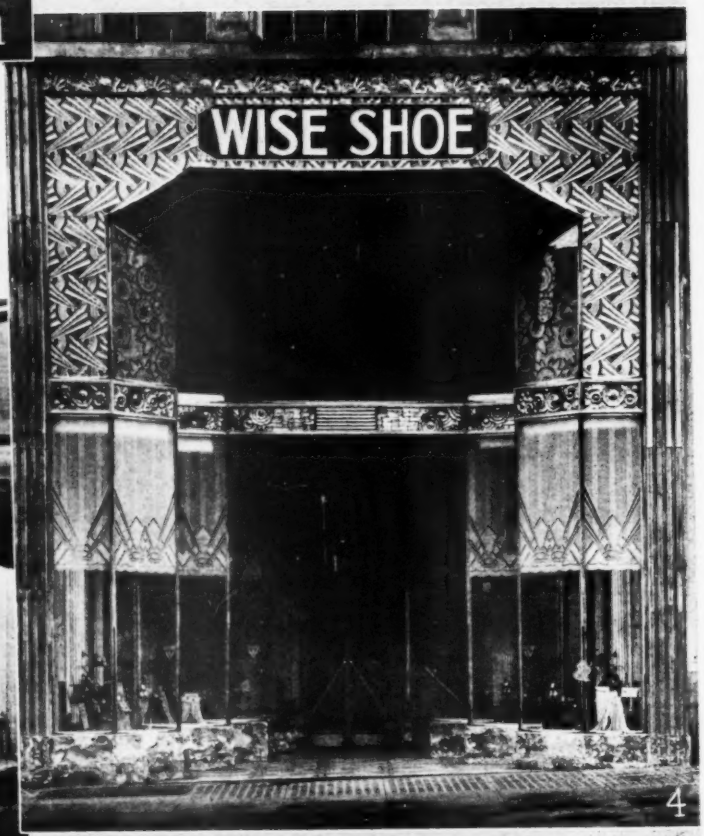
He was a valued contributor to THE GLASS INDUSTRY; to us his untimely death comes as a great and personal loss. His wife and a daughter, Betty, nine years old, and a son, Robert, four years old, survive him.

DECORATED GLASS TABLE IN THE SHOP OF J. THORPE, NEW YORK



GLASS DOOR PANELS AND CEILING LIGHTING FIXTURES, ST. REGIS HOTEL, FIFTH AVENUE, NEW YORK

SHOE SHOP, DETROIT, MICHIGAN, WITH GLASS SHOW WINDOW VALANCES, PANELS AND INTERIOR FITTINGS AND DECORATIONS.



SHOE SHOP, FIFTH AVENUE, NEW YORK, WITH ZIG-ZAG SHOW WINDOWS, DECORATED GLASS VALANCES, TRANSOMS, PANELS, INTERIOR FITTINGS AND DECORATIONS.

"Glass Craft Sculpture"

A New Process of Glass Decoration

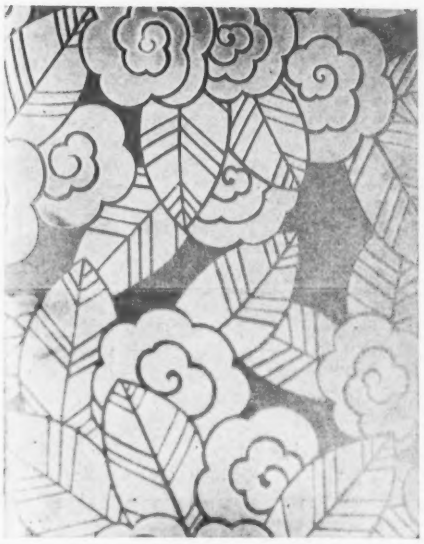
Modernistic designs executed in glass by a new bold relief process said to be of French origin, simulating carving and affording bas-relief reproductions of birds, flowers, airplanes, dolphins, sea nymphs, birds of rare and gay plumage, animals, reptiles and other objects in plain glass and colors, together with lighting variations, have been installed in the new Paramount Theatre, Brooklyn, New York, by the Eny Art Corporation of New York. Some of the details of the interior decorations are of curved glass, decorated by the new process, in plate of various thicknesses up to one inch.

This so-called "glass craft sculpture" so far has been principally embodied in broad designs which stand out from the background very effectively because of the deep cutting, but it is also employed in more delicate designs for numerous purposes. Many of the new styles are by Parisian designers. A typical design is seen in the slabs of glass supporting the table top in Figure 1.

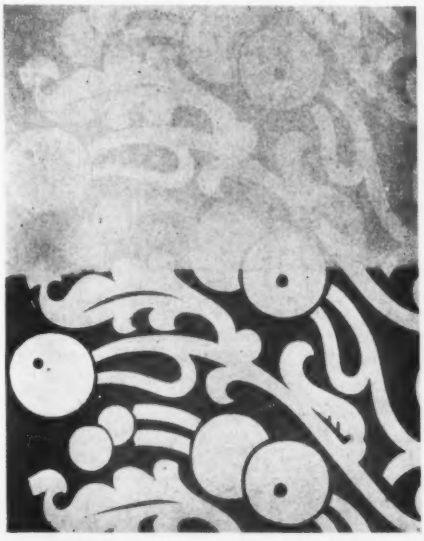
Some of the pieces in the Brooklyn theatre are of curved glass set in niches more than a foot deep. The polyform facets flash brilliantly when illuminated and produce remarkable effects. As a result, the atmosphere of richness and luxury is greatly enhanced.

Products made by the new process have also been applied to various other uses, some of which are illustrated herewith. It is used successfully for decorating objects of art, such as glass vases, bowls, etc. In addition to the installations here illustrated, the company has equipped a second "Wise" shoe store at Detroit. In Bamberger Brothers large department store at Newark, New Jersey, there is an installation of glass panels 108 by 120 inches in size, part of which are bent glass decorated. A large number of mirrors and glass tables of unusual design are included.

One of the New York installations already made is at Gimbel Brothers department store, which is using glass decorated by this process in exterior windows and for numerous holiday signs in the interior of the building. Sloan and Robertson, architects, have designed a grill room at Fifth avenue and Fifty-fifth street, with glass panels and lighting fixtures produced by the new process. One hundred and two doors in the great new fifty-two story Chanin Building on Forty-second Street, which will be the highest structure in the Grand Central district, will be decorated in glass by this new process. Sherry's Restaurant at Sixty-sixth Street and Madison Avenue and the Marcel Guerlain perfumery store in the Waldorf-Astoria is using the new glass. Out of town installations include Diamond Brothers dress house, Columbus, Ohio, with glass decorations, decorated glass window valances and lighting fixtures. Hoffman-Henon, architects and engineers of Philadelphia, have put into the new Boyd (Stanley) Theatre in that city a large amount of decorated glass of this type, and are doing likewise in the new Enright Theatre at East Liberty, Pittsburgh.



Typical Designs Showing Different Depths of Cutting



WINDOW TRANSOMS FOR A RESTAURANT

New Knox-O'Neill Suction Feed Bottle Machine

During the past month the Knox Glass Bottle Company, Knox, Pa., gave out to the trade information concerning a new bottle machine to be known as the Knox-O'Neill, developed in co-operation with Frank O'Neill, of the O'Neill Machine Company, Toledo, O., known everywhere for his inventions, extending over a long period of many years, in glass blowing machinery and used extensively in this and foreign countries.

The new machine, model No. 60, as operated at the Knox plant carries six blank and six blow molds and is designed especially for making ware up to six ounces in weight. It is of the vacuum-feed type and so designed that six bottles each of which may vary in design, finish, height and weight can be made during one revolution of the machine. Another model No. 65, will, it is stated, soon be placed on the market. It will be equipped with eight blank and eight blow molds capable of turning out eight bottles each of different design, finish, height, and weight, at each revolution of the machine.

The new machine is said to incorporate all the advantages of suction feed and do away with many of the disadvantages of the gob feeder. It is claimed that it produces a much larger percentage of high class ware of uniform height and wall thickness than it is possible to obtain with the gob type of feeder.

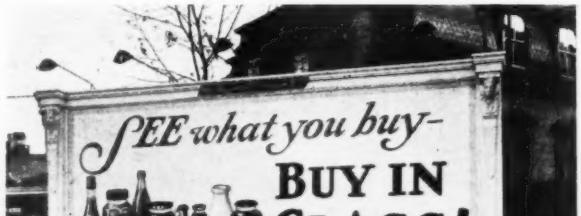
The Knox-O'Neill machine revolves continuously. No stoppage of the machine is necessary in order to feed the glass into the mold. The molten glass is taken from a revolving pot and a similar principle to that used in other vacuum processes is involved. The revolving pot, adjacent to the furnace and under cover, is supplied with molten glass through a channel. Each of the blow molds on the Knox-O'Neill machine is provided with its own blow head, which seizes the neck of the bottle and continues in contact with it until the blowing process is completed, thus, it is claimed, preventing defects that often occur with the use of the machines now in use. It is stated that the Knox-O'Neill machine will be a boon to the smaller manufacturers whose orders have not been great enough in volume to warrant the employment of a ten or fifteen arm suction machine of the types hitherto available. The trade has long looked forward to the time when a vacuum machine adaptable to the medium size plant would be obtainable. Some glassmen have favored the vacuum principle but through necessity have been compelled to use the gob feeder type of equipment. The performance of the Knox-O'Neill machine, therefore, will be followed with keen interest throughout the trade.

Knox Glass Bottle Company interests have been granted the exclusive right to sell the Knox-O'Neill machine in the United States. A company, the Knox-O'Neill Company, is being incorporated in Pennsylvania with an authorized capital of $2,000,000 to issue licenses and handle the sales of the machine. C. R. Underwood, formerly president and general manager of the Brockway Sales Company, Brockway, Pa., has become connected with the new organization. R. R. Underwood of the Knox Glass Bottle Company and president of the Marienville Glass Company and also interested in glass factories at Sheffield, Pa., and Parkers Landing, O., intends to equip the Marienville and Sheffield plants with the new machine as early as possible. A large number of advance orders are said to have been received from bottle manufacturers by those in control of the new invention and this will of course mean the replacement by the vacuum system of a large number of gob feeders.

How They Do It at Trenton

TRENTON, New Jersey, situated a little more than halfway along the 90 miles of Pennsylvania Railroad line from New York to Philadelphia and facing stiff big-store competition from both cities, shows in these attractive pictures one way in which she inveigles most of her 100,000 and more home citizens into buying high-class food products at her home stores.

Under the direction of V. V. Kelsey of the Erwin Feldspar Company, one of the city's most widely known business concerns, and a member of the Glass Container Association of America, a successful advertising campaign in favor of glass-packed staples and novelties has recently been conducted, various mediums being used, especially outdoor advertising, grocery store window displays and direct mail follow-up publicity to more than 500 retailers.



WHO COULD MISS THIS ONE?

TRENTON DEALERS DID THEIR SHARE

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington D. C. Price 10c each

New Patent on Barium Glass

PROCESS FOR THE MANUFACTURE OF GLASS CONTAINING BARIUM. U. S. 1,694,831. Dec. 11, 1928. Fritz Rothe and Hans Brenek, Berlin, Germany, assignors to Rhenania-Kunheim. Filed 10/11/26 and in Germany 10/16/25. According to the present invention barium silicate produced directly from heavy spar is melted with the usual glass forming substances. Thus barium sulphate is converted into barium silicate instead of into barium carbonate as hitherto, providing a product which is particularly suitable for the manufacture of glass and is also very cheap for this purpose. The procedure adopted is, for example, to heat a mixture of 100 parts of finely ground heavy spar and 13 parts of finely ground quartz sand in a revolving furnace, with direct heating and at the same time introducing steam, at temperatures of about 1200°. A reaction product is obtained by this means which is easily sintered, is absolutely free from sulphuric acid, and is characterized by its high content of barium oxide (82% BaO). This is particularly suitable for use in the production of baryta glass.

In order to obtain barium glass, 100 parts of sand, 26 parts of calcined soda, 15 parts of calcium carbonate and 34 parts of the barium silicate containing 82% BaO obtained from the heavy spar are melted down in the usual manner for the preparation of glass.

The inventor claims: 1. Process for the manufacture of barium glass which consists in melting barium silicate with glass-forming ingredients.

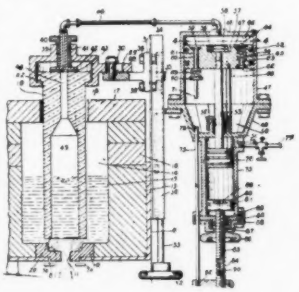
2. Process for the manufacture of barium glass which consists in melting barium silicate, containing more than 80% of barium oxide, with the usual glass forming ingredients.

3. Process for the manufacture of barium glass which consists in melting barium silicate, produced by heating heavy spar and silica in presence of steam, with the usual glass forming ingredients.

4. Process for the manufacture of barium glass which consists in melting barium silicate, produced by heating heavy spar and silica in presence of steam at a temperature above 1000° C. with the usual glass forming ingredients.

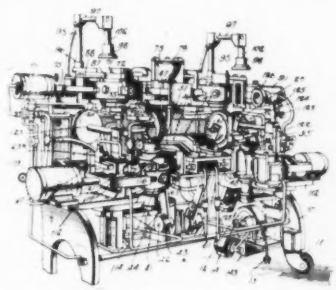
5. Process for the manufacture of barium glass which consists in melting barium silicate, produced by heating heavy spar and silica in presence of steam in a revolving furnace at a temperature above 1000° C. with the usual glass forming ingredients.

GLASS-FEED-CONTROL MECHANISM. U. S. 1,686,109. Oct. 2, 1928. Samuel G Stuckey, Middletown, Ohio. Filed 5/5/26. The combination of a tubular member with an open end adapted to be immersed in a body of molten glass above a discharge opening, an air conduit leading from the upper portion of the said tube, a cylinder with which the conduit connects, a control piston movable in the said cylinder, means for reciprocating the piston to cause alternate conditions of pressure and vacuum in the tubular member above the molten glass therein, control means for varying the quickness of movement of the control piston to produce pressure conditions, and other control means to vary the quickness of movement of the piston to produce vacuum conditions, such control means being operable independently of each other and of the speed of the apparatus as a whole.



FURNACE EFFICIENCY METER. U. S. 1,686,186. Oct. 2, 1928. Jacob M. Spitzglass, Chicago, Ill., assignor to Republic Flow Meters Company. Filed 1/12/27. A furnace efficiency meter comprising an indicator movable in accordance with the temperature of the stack gases and an indicator movable in accordance with the percentage of carbon dioxide in the stack gases, said indicators being so positioned that the temperature indicator moves away from the CO_2 indicator as the temperatures increase and toward it as the temperatures decrease and the CO_2 indicator moves toward the temperature indicator as the percentage of CO_2 increases and moves away as it decreases.

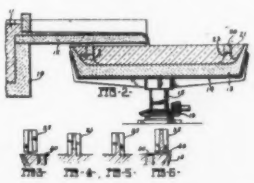
GLASS-BLOWING MACHINE. U. S. 1,694,486. Dec. 11, 1928. Clarence R. Nixon, Baltimore, Md., assignor to Baltimore Bottle Machine Corporation. Filed 6/14/27. A glass blowing machine entirely automatic in its operation from the time the mass of glass to form the bottle or other article is received in the machine to the time the finished article is ready for delivery. An improved machine of this character wherein the article being blown will be held throughout the first stage of the blowing operation on a suitable support or neck ring in a fixed position and then carried by the neck ring to the final blowing position.



LAMINATED GLASS AND PROCESS OF PRODUCING THE SAME. U. S. 1,693,729. Dec. 4, 928. James W. H. Randall, New York, assignor to Libbey-Owens Sheet Glass Company. Filed 11/17/27. The process of producing laminated glass, consisting in applying a rubber solution to one side each of two sheets of glass, allowing the films thus formed to dry, and then placing the two films in contact with each other, and uniting the same by the application of heat and pressure. The composition used is preferably a solution of resin free, bleached, crepe rubber dissolved in a suitable solvent such as benzol, or sweet gasoline. The pale crepe rubber is preferably freed from the contaminating resins, then bleached and dried before it is dissolved in a suitable solvent. This treatment also destroys certain oxidizing enzymes present in the crepe rubber, which, if allowed to remain, tend to color the rubber in time.

METHOD OF MANUFACTURING ELECTRIC BULBS AND BULB BLANKS FOR USE THEREIN. U. S. 1,694,368. Dec. 11. 1928. Clyde C. Bohner, Maplewood, N. J., assignor to Tung-Sol-Lamp Works. Filed 2/25/27. The method of manufacturing electric bulbs which consists in forming in the elongated neck of a bulb blank and in the plane of the seal and bulbous ring to cause a thinning of the glass walls thereat, assembling a mount within the bulb blank with the sealing flange of the mount disposed in the plane of the bulbous ring and then heating the latter to cause it to collapse upon and become welded to the flange.

GLASS-DELIVERY APPARATUS. U. S. 1,690,777. Nov. 6, 1928. Meyer M. Eppstein, Charleston, W. Va., assignor to The Owens Bottle Company. Filed 8/24/26. An object of the present invention is to provide means whereby the chilled stringy portions which are cut from charges drawn into the blank molds, will be forced to move beneath the surface of the glass in the revolving pot and become reheated and reassimilated before returning to the area from which charges are gathered, and thereby eliminate the noted objections. In this invention a wall is interposed between the gathering area and the surface of glass into which severed glass is dropped, said wall being provided with a submerged opening through which the severed portions return to the gathering area.



Fine Program Awaits Glass Division Members

As frequently announced, the thirty-first annual meeting of the American Ceramic Society will be held at the Stevens Hotel, Chicago, during Ceramic Week, February 4 to 9 inclusive.

The first American Ceramic Exposition will be held in conjunction with the meetings, at the same hotel.

These annual meetings have been increasing yearly in interest, value and attendance and any glass works executive or technical man who can possibly attend this one is sure to be richly rewarded not only by the information gained from the valuable papers to be presented in the Glass Division by numerous authorities on glass making problems but also by personal contact with many other persons interested in glass.

The other Divisions—Art, Refractories, Enamel, White Wares, Heavy Clay Products, and Terra Cotta have also prepared attractive programs.

The first day, Monday, February 4, will be devoted in the forenoon to "Our Associations" and in the afternoon to research programs of Associations, reports by representatives of the associations meeting concurrently during the week. Tuesday, Wednesday and Thursday will be devoted to Division meetings and concurrent and joint meetings with a number of other associations meeting in Chicago at the same time.

Glass Division

The papers scheduled on the tentative program of the Glass Division are as follows:

European Trip—Alexander Silverman and Frederick Carder. (Complete program arranged by Dr. Silverman)
Artistic Aspects of European Manufacture—Frederick Carder.
Color Technique—Henry R. Hellmers.
The Bicheroux Plate Glass Process—J. Earle Frazier.
Glass House Refractories—C. E. Fulton.
The Radiation Method of Measuring Strains in Glass and Their Effects on Physical Properties—L. R. Ingersoll.
Determination of the Source and the Prevention of Stones in Glass.—Herbert Insley.
Viscosity Measurement, H. R. Lillie.
The Devitrification of Glass, G. W. Morey.
Report of Progress on Absorbed Gases in Glass, E. W. Washburn.
Dimensional Changes Caused in Glass by Heating Cycles, A. Q. Tool, D. B. Lloyd and G. E. Merritt.
Manufacture of Fused Bifocal Spectacle Lenses, Robert Montgomery.
Chemical Composition and Physical Properties of Certain Glasses, S. D. Fetterolf.
Volatility of Selenium and Its Compounds in Manufacture of Selenium Ruby, J. B. Krak.
Density Factors for Soda, S. R. Scholes.
Rolling and Drawing of Sheet Glass, J. W. Cruikshank.
Analysis of Glasses, G. Lundell.
Temperature Measurements, W. E. Forsythe.
Effect of Zinc Oxide in Refractories, E. W. Washburn.
Corrosion Test of Refractories in Glass, G. S. Fulcher.

Art Division

The Art Division will have a symposium on color conducted by John F. Earhart, one on modern art and another on production problems in relation to profitable design. A preliminary list of 15 papers is scheduled for this Division as follows:

A Practical Philosophy of Modernistic Design for American Ceramics, Myrtle Merritt French.
The Relation of the Ceramic Artist in a High Grade European Factory to Other Workers, M. Sheerer
Duties of Designers in American Ceramic Manufactories, H. Morse.
Common Ware Made Beautiful. A. E. Baggs.
Lessons from the International Ceramic Exhibition, E. de F. Curtis.
Search and Research, Dr. Chas. F. Binns.
Study of the Technic of Persian Wares, Dr. Chas. F. Binns
Printing on Clay Wares from Linoleum Blocks, S. Loshinsky.
Art and Industry, W. Westfeldt.
Encrustation of Clay Wares, T. Lenchner.
To What End Ceramic Engineering? J. H. D. Allen.
A Study of Art in Tile, E. Burkhalter.
Some Leadless Borosilicate Glazes Containing Nickel Oxide, H. H. Holscher.
Wax Crayon Underglaze Colors for Use in Elementary Schools, W. Bricker.
Glass Problems Suitable for Use in Schools, Harold Nash.

Based on a statement received from the Association of Arts and Industries, 230 East Ohio Street, Chicago, an announcement was made in the December number that arrangements had been made for an exhibition of modern American decorative industrial art to be held at Mandel Brothers Department Store in that city opening January 17 and that the art division of the American Ceramic Society would hold its annual exhibit as part of the exposition. Since the item appeared, however, notice has been received to the effect that on account of unavoidable delays in organizing, the exhibit has been postponed to a date to be announced later.

The Art Division of the American Ceramic Society therefore will meet independently at the American Ceramic Exhibition.

Refractories Division

The Prediction of Service Value from Laboratory Test Data—A. E. R. Westman.
Effect of Bentonite on Green Strength of Fire Clay—M. E. Holmes.
Service Records of Mullite Refractories—T. S. Curtis.
Relation of Thermal Conductivity to Other Physical Properties of Insulating Materials—Hartman, Westmont and Weinland..
Progress Report on Thermal Conductivity Investigation—R. M. King.
Optical Methods as an Aid to Study of Refractories—T. N. McVay.
Fusion Temperatures of Magnesia, Alumina, Silica, Mixtures—E. F. Kern.
Equilibrium of Crystalline Silica and Silicate Melts—J. R. Creig.
Geologic Relation of Diaspore and Flint Fire Clays of Missouri—W. S. McQueen.
Science in Mineral Prospecting—R. B. Gilmore.
A Tunnel Kiln Refractories Plant—B. E. Whitesell.
Dry Pans—Clearfield Machine Company.
Dry Pressing—L. W. Floor, E. Hager.
Modern Firebrick Plant Layouts—F. M. Hartford.
A Coke Fired Producer for Ceramic Industry—H. C. Barrett.
Stability and Progress of Public Utility Fuel Service—E. L. Gates.
Effect of Typical Slags on Firebrick—C. E. Grigsby.
Test on Cupola Blocks—J. F. McKenzie.
Progress Report on Checkerbrick Investigation—R. M. King.
Comparative Tests on Monolithic Cements.—H. N. Clark.
X-Ray Powder Diffraction Patterns of Commercial Firebrick—A. E. R. Westman.
Progress Report on Investigation of Sagger Clays—R. A. Heindl and L. E. Mong.
Progress Report on Investigation of Fire Clay and Fire Clay Refractories—R. A. Heindl and W. L. Pendergast.

The Exhibition

Exhibits of ceramic products of many kinds will be on view at the American Ceramic Exhibition and supplies and equipment for the manufacture of glass and other ceramic products will also be shown.

Exhibitors in the Finished Products Section will include:

American Encaustic Tiling Co., Ltd., New York, N. Y.
Benjamin Electric Co., Chicago, Ill.
Cambridge Glass Co., blown and pressed glassware, etc., Cambridge, Ohio.
Carr-Lowrey Glass Co., Bottles and jars, etc., Baltimore, Md.
Champion Porcelain Co., Detroit, Mich.
Columbia Enameling & Stamping Co., Terra Haute, Ind.
Coonley Mfg. Co., Chicago, Ill.
Fostoria Glass Co.—Pressed, blown, and colored glassware, etc., Moundsville, W. Va.
The Haeger Potteries, Inc., Dundee, Ill.
Hazel-Atlas Glass Co.—Bottles, jars, tumblers, Wheeling, W. Va.
Homer Laughlin China Co., Newell, W. Va.
Lenox, Inc., Trenton, N. J.
The D. E. McNicol Pottery Co., Clarksburg, W. Va.
Mosaic Tile Co., Zanesville, Ohio.
Porcelain Tile Co., Chicago, Ill.
Scammell China Co., Trenton, N. J.
Sebring Pottery Co., Sebring, Ohio.
Steubenville Pottery Co., Glass, Steubenville, Ohio.
Vitrolite Co., Vitrolite Glass Products, Chicago, Ill.
The S. A. Weller Pottery Co., Zanesville, Ohio.

What Will Congress Do About the Tariff?

Glass Trade Watching Developments at Washington

The ever-present problem of American glass manufacturers, to obtain adequate protection against foreign competition with its trade-disturbing price-cutting proclivities, seems likely to become a very active issue at Washington in the near future.

Early in December the House Committee on Ways and Means agreed upon a program of hearings on all schedules of the present tariff law, to begin January 7 and continue until February 25. Fifteen sub-committees were appointed to take charge of specific schedules. Schedule 2, covering earths, earthenware and glassware was placed in the hands of H. W. Watson, chairman, C. B. Timberlake and Isaac Bacharach, and sub-committee hearings on these products are to be held on January 10 and 11.

One purpose of the hearings is said to be the desire of the House Committee on Ways and Means to prepare a bill on tariff revision for presentation should the new President call an extra session of Congress.

Since the present session of Congress opened, a number of bills have been introduced in the House looking to tariff revision, including one by Representative Manlove, of Missouri, a Republican, proposing a non-partisan Tariff Commission of experts, not appointed for political reasons.

An event which will strengthen the position of higher tariff advocates and put the influence of labor behind them, is the declaration made at New Orleans in November by the recently formed tariff organization, the American Wage-Earners' Protective Conference which is affiliated with the American Federation of Labor. A statement of principles and demands was adopted and it was voted to request the President-elect when he takes office to convene a special session of Congress to enact a new tariff law giving relief by preventing the importation of foreign products made in countries of low wage and living standards, which now flood this country to the detriment of the workers in many industries.

Throughout the glass manufacturing industry there seems to be a strong feeling that on the evidence, alone, brought out at the tariff hearings on plate glass, the 50 per cent increase in duties requested by the plate glass industry cannot be refused and that a substantial increase on window glass duties will also be given.

Questioned recently on the probable outcome of the impending agitation in Congress on the glass tariff question, a number of glass manufacturers have expressed themselves forcibly. A statement made to this journal recently by W. L. Clause, Chairman of the Board of Directors, Pittsburgh Plate Glass Company, follows:

> "The best evidence of the inadequacy of the existing tariff on plate glass is the great increase of imports used largely on our Atlantic and Pacific seaboards. Never in the history of our country has the American product been so largely displaced on our seaboard as during the operation of the present tariff. The disparity between foreign and domestic labor is almost twice as great as it was before the war."

Frank Bastin, President of the Blackford Window Glass Company, Vincennes, Ind., expressed himself in the following terms:

> "My views on the tariff question can only be a repetition of what has been recently stated over and over again in connection wth the hearing before the U. S. Tariff Commission held in Washington in the early part of September. In order to have adequate protection the difference in cost should be equalized so that the domestic article will meet the foreign article at the point of consumption on an equal basis. There is now on file in Washington available to the sub-committee of the House of Representatives an abundance of data bearing on costs both here and in Belgium, which happens to be the main competitive country, and I feel that by reason thereof our industry is in much better shape to command and secure adequate relief than it was previously when tariff revisions were contemplated by Congress."

Tariff Commission Discusses "Flexible" Provisions

In the annual report of the U. S. Tariff Commission the constitutionality of section 315 of the Tariff Act of 1922, which covers the so-called flexible tariff provisions, was discussed in the light of court decisions made during the past year.

In a case cited by the Commission the importers had two contentions—first that section 315 is invalid in that it delegates to the President a legislative power rightly invested in Congress; and second, it is invalid because enacted with the avowed purpose of protecting the industries of the United States and that the Constitution provides that Congress may lay taxes only for revenue.

The court stated that it seems clear what Congress intended when section 315 was enacted. Its plan was to impose duties on imported merchandise that would put domestic producers on terms of equality with foreign producers in the United States markets.

"It may be that it is difficult to fix with exactness this difference [in costs] but the difference which is sought in the statute is perfectly clear and perfectly intelligible."

"As it was a matter of great importance, Congress concluded to give by statute to the President, the chief of the executive branch, the function of determining the difference as it might vary. He was provided with a body of investigators who were to assist him in obtaining needed data and ascertaining the facts justifying readjustments."

Congress has the right to authorize the Chief Executive to carry out its purpose.

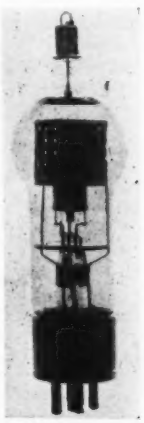
Purchase of Celite Products Company Completed

The purchase by the Johns-Manville Corporation of New York of the assets and products of the Celite Products Company, mentioned in the December number, has been completed. This transaction brings to Johns-Manville an annual business of over $4,000,000 in net sales of high temperature insulation and kindred lines made from diatomaceous earth—a fossilized deposit derived from ancient sea life. An even more valuable asset, however, is the Celite holdings of this deposit in California, which is one of the largest known sources of this kind and quality. In addition to insulating products, the Celite Products Company has been a large producer of filtration materials extensively used in sugar mills, oil refineries, sewage disposal plants, etc. Celite for concrete, one of the newer uses of Celite, is already one of the largest developments of this product. Its primary function is that of greatly increasing the workability of concrete.

The executive and sales personnel of the Celite Products Company has been welcomed into the organization of the Johns-Manville Corporation and Theodore E. Merseles, president of the latter company has assured its customers and friends that the high standards of manufacture and service established by the former company will be maintained and that it is hoped to offer even greater service than has ever been possible in the past.

Electric Furnace Temperature Control

Among the new research developments of the General Electric Company during the past year was the adaptation of a thyratron tube to furnish temperature control. The temperature of the furnace is measured by a thermocouple or resistance thermometer connected to the grid circuit of the thyratron in such a way that, when the temperature is below the desired point, the thyratron carries current sufficient to operate a contactor requiring two or three amperes. In the past, very delicate mechanical devices have been used as relays to enable the heavy furnace currents to be controlled from the extremely minute currents from thermometers. The thyratron supplies the most sensitive relay means yet found for amplifying these feeble impulses to control the large amounts of power used for furnace heating.



Another development recently described in this journal is a new colorimeter or spectrophotometer which duplicates exactly any color at any time and any place. The instrument automatically, rapidly and precisely, measures the wave lengths of colors of any substance and also makes an accurate record by which it is possible to reproduce it. It eliminates human judgment in the determination of colors. Still another of the company's new products is a tool material composed of tungsten carbide and cobalt.

The Glass World and What It Is Doing

News of the Industry

Byrd Is Distributing Owens' Bottles

Much has been printed in the newspapers concerning the specially lettered bottles which the explorer, Commander Richard E. Byrd, will throw into the ocean from his ship at given points during his Antarctic Expedition into the barren uncharted wastes of the South Pole. For years to come notes and information placed in hundreds of bottles are expected to be found floating on the seas or cast upon far away beaches.

On each is engraved the name of the Byrd Antarctic Expedition with the dates 1928 and 1929. Above the inscription is the reproduction of an airplane. At definite intervals, bottles furnished by the Owens Bottle Company of Toledo, Ohio, containing notes of location will be dropped over the sides of the ships and airplanes. The bottles also will contain instructions regarding their finding and forwarding which will give to scientists valuable information concerning the intensity and direction of the currents of the southern waters and their effect on other seas.

Although many of the bottles may be found in different parts of the world within a few months after they are cast into the seas, it may be one, two or many years before others are discovered. While the bottles will be subject to widely varying conditions, sudden chilling, hard knocks and the corrosive action of briny water, they will stand up and are no different in structure or material from thousands of other bottles dispensed every day over prescription and other counters.

Eleven Months Construction Record

New construction started in the 37 states east of the Rocky Mountains during the first eleven months of this year, amounting to $6,195,529,800, shows an increase of 6 per cent over the amount started during the corresponding period of last year, according to F. W. Dodge Corporation. The territory covered in the 37 states represents about 91 per cent of the country's total construction. Of the eight districts reviewed below, three of them have shown increases over their totals for the entire year 1927. These districts are: The New England States, the Middle Atlantic States and the Central West.

During November there was $471,482,200 worth of contracts let on new building and engineering work in this area. The above figure shows a gain of 1 per cent over the total for November of last year, but there was a loss of 21 per cent from the October 1928 total.

Mirror Manufacturers Pittsburgh Meeting

The National Association of Mirror Manufacturers at their meeting held in Pittsburgh on December 4 and 5 elected North Storms as secretary to fill the vacancy caused by the resignation of Harry C. Sorden. It was decided best not to elect a permanent president and the chairman of each meeting is to be appointed by the executive committee. The following manufacturers were elected to serve as directors for the term of one year:

George H. Anderson, Geo. H. Anderson & Co., Chicago, Ill.
Mr. Childers, Southern Mirror Co., High Point, N. C.
Mr. Connelly, Connelly-Kelly Glass Co., Holland, Michigan.
Mr. Emerson, Emerson Mirror Corp., Jamestown, N. Y.
Fred Hagemann, Hagemann Glass Co., Cincinnati, O.
Arthur Kahn, Kahn Glass Co., St. Louis, Mo.
Kendle Central Glass Co., Louisville, Ky.
Edward Stott, Stott-Hecht Glass Co., Philadelphia, Pa.

Geo. H. Anderson was elected treasurer for a term of one year.

Investigation of Meat Packaging in Glass

Consumers preferences for package meats will be studied in the Pittsburgh trade area, by the University of Pittsburgh through its Bureau of Business Research. The purpose is to determine both the choice of the consumer for packaged as against bulk goods, and also the preferences for various types of containers, including glass, paper, wood and metal. The survey will be made under the direction of Dr. John H. Cover, director of the bureau. The work is being financed through a grant made by *The National Provisioner*, Chicago, and is known as The National Provisioner Package Survey.

Eleven Months' Plate Glass Production

Figures compiled on the production of plate glass in November by P. A. Hughes, secretary of the Plate Glass Manufacturers Association, show a total production of 10,978,166 square feet. The production for October was less, amounting to 10,504,966 square feet. The total production for the eleven months of 1928 amounted to 113,046,086 square feet, exceeding the total production for the year 1927 by over 1½ million feet.

Engineers Will Visit Kingsport

Tentative plans for a meeting of the American Society of Engineers to be held at Knoxville, Tenn., March 21-23, 1929, include a visit to Kingsport, Tenn., "the miracle city of the South," which ten years ago was a bare mountain village but now has a glass works, the largest plant in the world making complete books, a wood by-product plant, textile mills and a cement plant.

Trade Activities

Independent Glass Company, Cumberland, Md., has been incorporated with a capital of $10,000 by William L. Lutz and Mary E. Ward, to manufacture bottles, etc.

Hartford Empire Company, Hartford, Conn., several weeks ago confirmed the report that they had purchased the United States patents of the Rankin Automatic Glass Feeder Company.

Eagle Glass Company, giving the address of 60 Park Place, New York, is reported incorporated with a capital of $125,000 by Benjamin C. Kligerman, 121 Connecticut Avenue, Atlantic City, N. J.

The United States Glass Company, Pittsburgh, Pa., recently elected Charles D. Marshall, of McClintic-Marshall Company, to fill the vacancy caused on the board of directors by the death of David Yost last summer.

Sinclair Glass Company, Voorhis, W. Va., J. A. Morehead, president, is reported to have leased a building in Huntington, W. Va., containing 50,000 square feet of floor space to manufacture headlight and signal lenses and glass novelties.

Consolidated Products Company, 15 Park Row, New York, buyers and sellers of equipment relating to various industries including glass manufacturing, announce that they have increased their telephone service and their numbers now range from Barclay 0600 and all consecutive numbers up to 0608.

The Sandusky Glass Manufacturing & Supply Company, Sandusky, O., started a fire in their tank on December 14. The plant had been idle since 1926 and has been remodelled with Fourcault equipment. S. A. McKittrick is vice-president and general manager and Dr. Henry Graefe is president. The plant was formerly known as the Central States Flat Glass Company.

The Kokomo Opalescent Glass Company, Kokomo, Ind., according to recent reports have obtained a judgment for $156 against the Postal Telegraph Company for an error in the transmission of a message which led the glass company to over-fill a contract. The customer refused to take the full quantity shipped and a loss resulted for which they made claim in the circuit court.

William C. Flanagan, treasurer of the Flanagan & Biedenweg Company, is now located at 25 Dearborn Street, Chicago, Room 406, as a specialist in flat colored glass. Mr. Flanagan states that this will not affect the Flanagan & Biedenweg Company who will continue doing business at 312-321 West Illinois Street, Chicago, where it has been engaged for the past forty years in the manufacture of leaded art glass exclusively.

Wilckes-Martin-Wilckes Company, New York, manufacturers of chemicals for the glass and other trades, held an

annual dinner and entertainment for their employes on December 11, at Toppin Inn, Westville, N. J. The gathering was turned into a Christmas party and a testimonial to John J. Heck, superintendent of the company's works at Camden, N. J. Ferdinand Wilckes, president of the company, addressed the gathering, outlined the company's general policies and reviewed the outlook for business during the coming year. Luther Martin paid tribute to several employes of the company who have been in service with this concern over fifteen years. George T. Short, recently elected to the board of directors, spoke on closer relationship between the management and the employe. A musical program was given by members of the organization from the Camden plant and New York office.

Industrial Publications

Transmissive Properties of Eye-Protective Glasses and Other Substances, by W. W. Coblentz and R. Stair, Bureau of Standards Technologic Paper, No. 369. For sale by the United States Government Printing Office, Washington, D. C. Price 10 cents.

Electric Heat in General Electric Factories. A 32-page bulletin issued by the General Electric Company, Schenectady, N. Y., which itself is now one of the largest users of electric heat. Numerous typical installations of electric heat are described including its use for annealing bottles, miniature lamp bulbs, plate glass and special ware.

The Kellerflex Grinder, a new flexible grinder designed for innumerable uses. Keller Mechanical Engineering Corp., 70 Washington Street, Brooklyn, N. Y., a twelve-page catalog illustrating this machine and giving its specifications. This machine is used by a number of manufacturers of glassware for grinding the edges of plate and sheet glass and numerous other purposes. Copies of the catalog may be obtained by writing to the manufacturer.

Personal

Dr. Eugene C. Sullivan, formerly vice-president and in charge of manufacturing of the Corning Glass Works, Corning, N. Y., is now president of that company, having taken that office last August. The executive committee now consists of Alanson B. Houghton, who is the United States Ambassador to England, and Alexander D. Falck.

Professor Alexander Silverman, head of the Department of Chemistry of the University of Pittsburgh, delivered an illustrated lecture entitled, "The Chemistry and Technology of Glass" at the one hundredth meeting of the Toledo Section of the American Chemical Society on December 7.

Abram F. Myers, elected chairman of the Federal Trade Commission last November, has resigned from the commission.

Recent Deaths

A. R. Payne

Arthur Raymond Payne, chief chemist of the Fostoria Glass Company, died suddenly on December 26. Further particulars are given on page 15.

William E. Conroy

William E. Conroy, president of the Conroy-Prugh Glass Co. died December 9 at Raleigh, N. C., where he had been in a hospital for several days. Several years ago Mr. Conroy became general manager of the glass company. He was appointed secretary in 1910 and in 1913 became vice-president and secretary, and later became president. He was an officer and director in several banks and manufacturing companies.

Coming Meetings

American Ceramic Society, Pittsburgh Section, will meet Tuesday evening, January 8, at the Fellows Room of the Mellon Institute, Pittsburgh, Pa. Arthur E. Baggs of the Ceramic Art Department of Ohio State University will speak on "The Importance of Form in Ceramics."

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

Philippine Islands—35189, Cheap glass tumblers.
Nigeria—35183, glassware and crockery.
Germany—35167, glass and crystal ware.

Inquiries Received

For further information address THE GLASS INDUSTRY

445. Where can we have made a glass, 14 ft. in diameter?

446. Where can we buy cheap glass door plates in 100 gross lots?

447. Can you put us in touch with several manufacturers who might be in a position to supply old style liquor bottles to be used for non-alcoholic cordials? We want odd-shaped bottles of any description.

448. We are interested in obtaining the address of a maker of bottles whose trade mark is the letter A enclosed in a circle and followed by the figure 6.

449. Can you supply me with the names of concerns who make crystal beads or glass to make these beads?

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE, DECEMBER 19, 1928
Reported by Moore, Leonard & Lynch, Union Bank Bldg., Pittsburgh, Pa.

	Bid	Asked	Last
American Window Glass Mch., Com	..	..	29¾
American Window Glass Mch., Pfd	50	..	50
American Window Glass, Pfd	..	90	90
United States Glass	12	12½	12½
Pittsburgh Plate Glass	..	..	278
Pittsburgh Plate Glass (New)	..	..	65
Standard Plate Glass, Com	..	..	4⅛
Standard Plate Glass:			
Pfd. Cumulative	..	..	16¼
Prior Pfd.	25	..	28

TOLEDO, O., DECEMBER 19, 1928

	Bid	Asked	Last
Owens Bottle, Pfd	..	..	115
Libbey-Owens Sheet Glass, Com	156	160	157
Libbey-Owens Sheet Glass, Pfd	115	..	..

WHEELING STOCK EXCHANGE, DECEMBER 27, 1928

	Bid	Asked	Last
Hazel-Atlas	98½	99½	99½
Imperial	..	33	72
Fostoria	185	..	185
Central	..	..	75
Jefferson, Pfd	..	..	96

READERS' WANTS AND OFFERS

FACTORY MANAGER

Position wanted, by Factory Manager capable of handling continuous, day, and recuperator tanks fired with natural gas, producer gas, or oil. Can make glass, operate Miller, Lynch, and O'Neill machines under Hartford-Empire, Miller, or private feeders, making bottles, packers' ware, pressed ware, and thin blown tumblers. Can handle men and give reference. Address SW-5, care THE GLASS INDUSTRY, 50 Church St., New York.

Place Your Orders
For BOUND VOLUMES of 1928
THE GLASS INDUSTRY
Price $5.00
50 Church St., New York

Current Prices of Glass-Making Materials

December 20, 1928

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid			
Citric (dom.)	lb.	.46	.46
Hydrochloric (HCl) 20° tanks, per 100 lb	lb.	..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.	lb.	5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	.38	.38
Alcohol, denatured	gal.	..	.53
Aluminum hydrate ($Al(OH)_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb.	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.21
Ammonia water (NH_4OH) 26° drums	lb.	.03	.03¼
Antimony, metallic (Sb)	lb.	..	10
Antimony oxide (Sb_2O_3)	lb.	..	.13
Antimony sulphide (Sb_2S_3)	lb.	..	.13
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.05
Barium carbonate ($BaCO_3$)			
Precipitated	ton	57.50	60.00
Natural, powdered, imported	ton	45.00	50.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	.05
Barium nitrate ($Ba(NO_3)_2$)	lb.	08¼	.08½
Barium selenite ($BaSeO_3$)	lb	..	..
Barium sulphate, in bags	ton	28.00-35.00	..
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton	..	16.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb	.02½-.03	.02¾-.03¾
Boric acid (H_3BO_3)	lb.	.06½-.07¼	.06¾-.07¾
Refined	lb	.06½-.07¼	06¾-.08
Cadmium sulphide (CdS)—			
Red	lb	..	1.20
Orange	lb	..	1.00-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.24	.25
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	.	.30
Cryolite ($Na_3Al\ F_6$) Natural Greenland Kryolith)	lb.	.09	.10-.10½
Artificial or Chemical	lb		.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.30
Feldspar—			
100 mesh	ton	13.00-20.00	15.50-22.00
80 mesh	ton	11.00-11.75	14.50
40 mesh	ton	11.00	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2, 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	.08	.08½
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.03¼-.03½
Black (FeO)	lb.	.03½	..
Kaolin (f.o.b. mine)	ton	9.00	..
English, lump, f.o.b. New York	ton	14.50-25.00	24.50-30.00
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb	.09-.09¾	.09¾-.10
Litharge (PbO)	lb.	.078-.08¾	.08¾-.09
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	11.50-12.50	..
Burnt (CaO) ground, in bulk	ton	8.00	..
Burnt, ground, in paper sacks	ton	10.00-11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15-2.25	2.30-2.60
Limestone ($CaCO_3$)		2.00	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.08
Manganese 85% (MnO_2)	lb.	.04	.04½
Nickel oxide (Ni_2O_3), black—			
for nickel content	lb.	..	.35
Nickel monoxide (NiO), green—			
for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	23.00-28.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08½	.09
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.07
Hydrated 80-85%	lb.	.05¾	.06¼
Potassium chromate (K_2CrO_4)	lb.	..	.26-.28
Potassium hydrate (KOH) (caustic potash)	lb.	.07⅛	.09
Potassium nitrate (KNO_3) (gran.)	lb.	.	.05⅞-.06
Potassium permanganate ($KMnO_4$)	lb.	.16	.16½
Powdered blue	lb.	..	24-.26
Rochelle salts. bbls.	lb.	..	.23
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb	..	1.90-2.00
Silver nitrate ($AgNO_3$)	(100 oz.) per oz.	..	.40⅜
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½	..
In barrels	Per 100 lb.	1.55-1.57½	2.40
In bags	Per 100 lb.	1.37½-1.40	..
Spot orders.. .025 per 100 lbs. higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07¼
Sodium hydrate ($NaOH$) (caustic soda) Solid	Per 100 lb.	2.90	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04½
95 per cent	Per 100 lb.	2.17½-2.20	2.50
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.39	.37½
Tin oxide (SnO_2) in bbls.	lb.	..	.56
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb	..	1.50-2.25
Zinc oxide (ZnO)	lb.	.08½	.12
American process, Bags	lb.	.06½	.07
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to November 23, 1928

	October 1927 Quantity	October 1927 Value	October 1928 Quantity	October 1928 Value	Ten Months Ending October 1927 Quantity	Ten Months Ending October 1927 Value	Ten Months Ending October 1928 Quantity	Ten Months Ending October 1928 Value
Glass and glass products (total)	.....	791,586	.....	992,301	.....	7,397,712	.....	8,323,195
Plate and window glass—								
Window glass, common, box 50 sq. ft.	1,228	7,379	1,616	8,546	19,215	103,955	13,157	80,977
Plate glass, unsilvered, sq. ft.	104,761	30,988	252,731	82,894	874,380	279,670	1,958,764	584,011
Other window and plate glass	lbs.	274,842	.....	312,439	3,521,645	365,678	2,777,320	327,980
Glass containers (bottles, vials and jars)	235,387	28,077	440,860	65,019	.....	2,619,044	.....	2,984,652
Table glassware, plain	.....	136,867	.....	145,708	.....	1,198,415	.....	1,119,343
Table and other glassware, cut or engraved	.....	13,751	.....	11,350	.....	116,820	.....	119,661
Lamp chimneys and lantern globes	lbs.	107,286	21,118	82,716	19,532	1,540,728	314,569	1,402,814	284,698
Globes and shades for lighting fixtures	lbs.	123,349	43,184	164,119	60,510	1,368,239	500,081	1,475,246	523,196
Chemical glassware	lbs.	24,312	19,699	23,041	18,204	178,015	158,439	184,391	159,621
Electrical glassware, except for lighting	lbs.	165,394	15,504	680,662	53,044	1,905,991	195,831	4,055,569	338,412
Other glassware	.....	.....	200,177	.....	215,055	.....	1,545,210	.....	1,800,644

IMPORTS

Corrected to November 23, 1928

Glass and glass products	.....	1,595,644	.....	1,583,207	.....	14,157,863	.....	12,934,111
Cylinder, crown and sheet—								
Unpolished—								
Weighing less than 80 pounds per case	dut. lb.	3,685,647	107,931	3,449,554	99,691	40,223,222	1,057,237	31,223,514	963,487
Weighing 80 pounds or over per case	dut. lb.	2,683,959	115,213	2,547,672	102,593	33,027,531	1,410,264	26,529,427	1,183,471
Bent, ground, beveled, colored, painted, etc., and polished	dut.	.....	33,775	.....	38,622	.....	322,823	.....	465,048
Plate glass—									
Polished, unsilvered	dut. sq. ft.	1,028,367	270,718	1,463,169	296,185	13,270,414	3,768,962	13,125,306	2,833,632
Other	dut. sq. ft.	113,319	29,216	116,503	32,681	1,041,511	250,329	1,433,078	392,687
Bottles, vials, jars, demijohns and carboys, molded or pressed	dut.	.....	11,178	.....	29,265	.....	159,168	.....	207,277
Table and kitchen utensils	dut.	.....	36,827	.....	31,154	.....	142,739	.....	234,634
Glassware, cut or decorated	dut.	.....	462,474	.....	324,123	.....	3,102,924	.....	2,357,474
Blown glassware, n. e. s.—									
Bottles, ornaments, gauge glasses and other n. e. s.	dut.	.....	241,249	.....	304,125	.....	1,420,488	.....	1,720,711
Bulbs for electric lamps	dut. No.	1,271,009	15,850	1,512,867	20,101	12,094,645	121,407	12,471,296	140,587
Chimneys, globes, shades, prisms and other illuminating glassware	dut.	.....	95,783	.....	118,930	.....	765,777	.....	797,003
Articles and utensils for chemical, scientific, and experimental purposes	dut.	.....	42,636	.....	53,306	.....	440,129	.....	461,156
Other glassware	dut.	.....	132,794	.....	132,431	.....	1,195,616	.....	1,176,944